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Science for Tomorrow's World

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THE MACMILLAN SCIENCE SERIES

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J. DARRELL BARNARD
SCIENCE EDUCATION

CELIA STENDLER
CHILD DEVELOPMENT AND ELEMENTARY EDUCATION

BENJAMIN SPOCK, M.D.
HEALTH CONSULTANT

UNDER THE EDITORSHIP OF

SIDNEY SELTZER

SCIENCE FOR TOMORROW'S WORLD: 1, 2, 3, 4, 5, 6
SCIENCE: A SEARCH FOR EVIDENCE 7
SCIENCE: A WAY TO SOLVE PROBLEMS 8
SCIENCE: A KEY TO THE FUTURE 9

Texts, Teachers' Annotated Editions, and other Complementary and Supplementary Teaching Materials

THE MACMILLAN SCIENCE SERIES

Science for Tomorrow's World 2

J. DARRELL BARNARD

CELIA STENDLER

BENJAMIN SPOCK, M.D.

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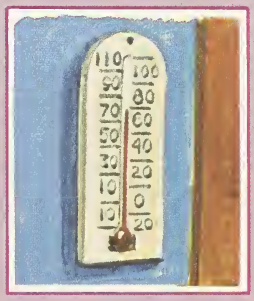

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The Scientist's Way

1

Finding Out

Tom and Jane and other boys and girls in the class are finding out about many different things. What can they smell, taste, and hear? What can they feel? What can they see? You will find out about things in many ways, too.

What are these things? Tell what you know about them. How did you find out?

What did you find out by smelling?
What did you find out by tasting?
What did you find out by hearing?
What did you find out by feeling?
What did you find out by looking?
You can find out about things in many ways.

Can You Guess by Smelling or Tasting?

Let someone get these things for you. Do not look. Guess what each thing is by smelling it.

Onion

Candle

Banana

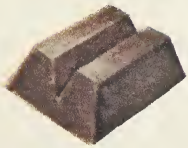
Apple

Let someone get these things for you. Do not look. Guess what each thing is by tasting it.

Sugar

Salt

Lemon

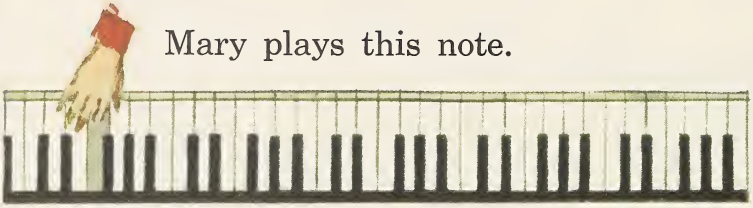


Bitter chocolate

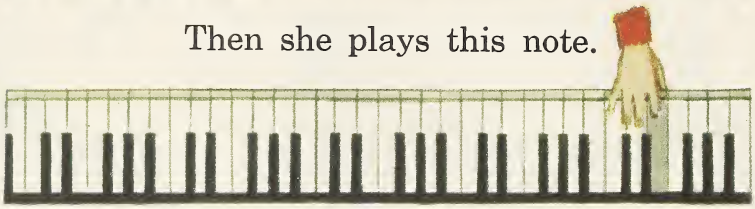
Finding Out by Hearing

You can find out about things by the way they sound.

Mary plays this note.



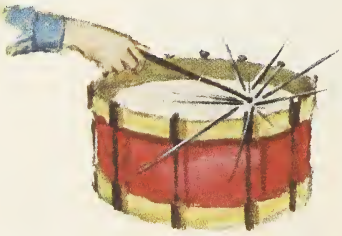
Then she plays this note.



How are the sounds different?

Tom hits the drum gently.

Tom hits the drum hard.



How are the sounds different?

You can tell by hearing. Are the sounds high or low?

You can tell by hearing. Are the sounds loud or soft?

What else can you find out by hearing?

Finding Out by Feeling

You can find out about things by the way they feel.

Which things feel cold? Which things feel warm?

Which things feel hard? Which things feel soft?

You can feel if things are cold or warm.

You can feel if things are hard or soft.

What else can you find out about things by feeling?

Can You Tell by Looking?

Bob has two cans of sand.

He puts one can of sand into a jar for Mary.

He puts one can of sand into a jar for Jerry.

Does Jerry have as much sand as Mary?

Mother is making cookies.

She gives some dough to Mary. She gives just as much dough to Jerry.

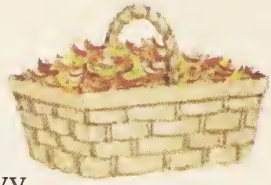
Mary makes her dough into a big cooky.

Jerry makes his dough into small cookies.

Is there more dough in the big cooky than in the five small cookies?

How can you be sure your answer is right?

Can You Always Tell by Looking?



Here is a big basket.

Mary thinks it is very heavy.

Mary picks up the basket. What does she find out?

Here is a little pail. Mary thinks it is not heavy.

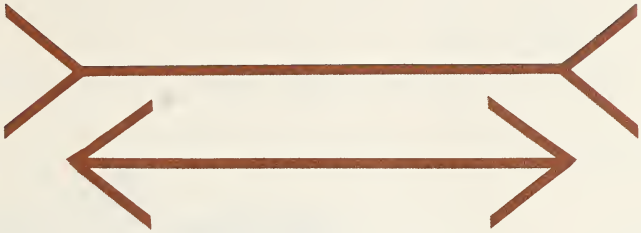
She picks up the pail. What does she find out?

You cannot always tell how heavy things are by the way they look.

Some big things can be light.

Some little things can be heavy.

Does one red line look longer than the other line?



Is one red line really longer than the other? How can you find out?

Does one circle look bigger than the other?

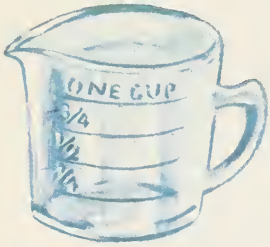
Is one circle really bigger than the other? How can you find out?

Sometimes you cannot tell how big a thing is by the way it looks.

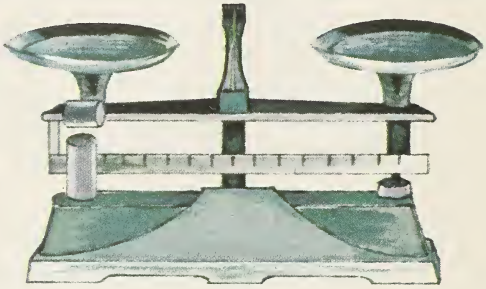
Finding Out by Measuring

You cannot always find out about things just by seeing or feeling them. There are ways to find out more.

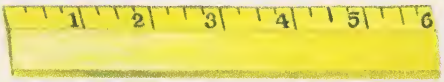
What do these things help you find out?



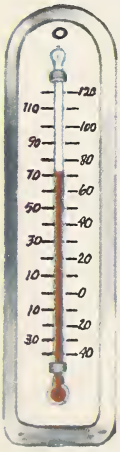
Measuring cup



Scale



Ruler



Thermometer

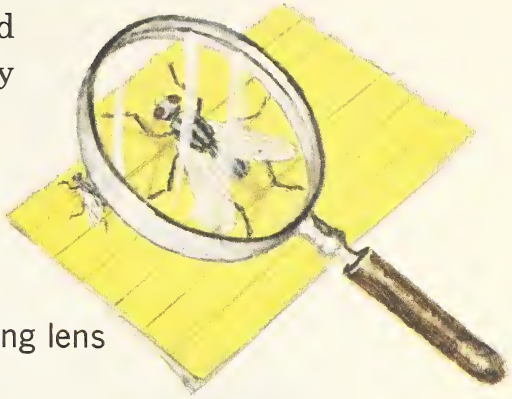
Speedometer

Clock

Making Things Look Bigger

Sometimes you can find out more about things by making them look bigger.

This can help.



Magnifying lens

Microscope

Some things are much too small for you to see without help.

This can help.

Some things are too far away to see well.

This can help.

Field glasses

How Judy and Fred Found Out

Judy and Fred found something on the way to school. They found it on a tree.

They looked at it. They saw that it was long and round. But they did not know what it was.

Fred said, "Let me feel it."

Judy said, "No, don't feel it. Maybe there is something in it. You might hurt it. Let's take it to school. We can ask our teacher what it is."

Judy and Fred asked their teacher.

She said, "I'm glad you were careful. This is a **cocoon.** There is something alive in here."

Judy and Fred found out some things by asking.

The teacher gave Judy and Fred some books with stories about cocoons. Judy and Fred found out still more things by reading. This is what they found out.

A **caterpillar** made the cocoon. When the caterpillar was little, it ate and ate. It grew bigger and bigger. After a time, it made the cocoon around itself. Then the caterpillar changed itself inside the cocoon.

Judy and Fred wanted to know what would happen to their cocoon. The teacher said, "Let's wait and see."

They put the cocoon in a jar. They made sure that air could get in. They knew living things need air. The caterpillar in the cocoon was alive, so it would need air.

Judy and Fred looked at the cocoon every day. They watched the cocoon for many days.

One day the cocoon looked different. Something was happening. Something was coming out of the cocoon. It was not a caterpillar. What was it?

The teacher said it was a **moth.** A moth came out of the cocoon.

Judy and Fred found out some things by watching for a long time.

This is the moth that came out of the cocoon.

Judy and Fred wanted to know the name of their moth. They looked in books. They found a picture that looked just like their moth. It had the same colors. It had a name.

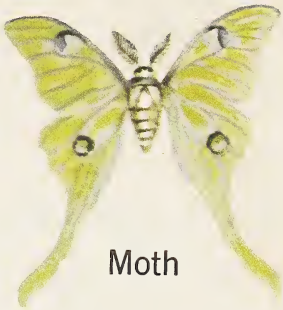
Judy and Fred found out by looking and reading.

Can you do what Judy and Fred did? Can you find out the name of their moth? Where would you look?

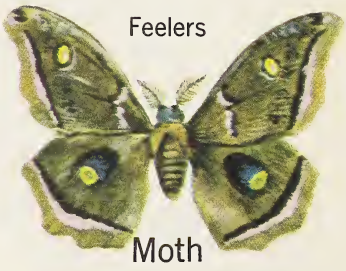
Finding Out by Looking and Reading

What looks like a moth? You are right if you say a **butterfly.**

You can find out more about moths and butterflies by looking at them. You can find out about moths and butterflies by reading about them.



Moth



Moth

Butterfly

Moth

Butterfly

Butterfly

Look at the pictures here.

Are all the moths the same?

How are they different?

Are all the butterflies the same?

How are they different?

Do the moths have **feelers** on their heads?

Do the butterflies have feelers?

Are a moth's feelers different from a butterfly's feelers?

How are they different?

Moths and butterflies are alike in some ways.

Moths and butterflies lay eggs. Caterpillars come out of the eggs. Butterfly caterpillars turn into butterflies. Moth caterpillars turn into moths.

Moths and butterflies are different in some ways.

A moth's feelers look different from a butterfly's feelers.

Moths fly at night. Butterflies fly in the daytime.

What did you find out from reading? Can you find out the same things from the pictures?

What did you find out from the pictures? Can you find out the same things from reading?

Can you think of things about moths and butterflies that you did not find out at all?

Finding Out by Watching

Fish must live in water. They cannot live in air as we do, or as moths and butterflies do.

You can make an **aquarium** to see how some fish live. An aquarium is a home for plants and animals that live in water.

You will need fish and plants and sand for your aquarium. Put some **snails** in your aquarium, too.

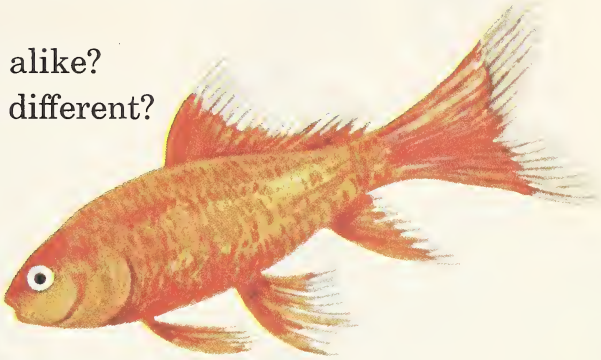
When you take care of the fish, you will find out what they need. When you watch the fish, you will see what they do. You can find out about the plants and snails by watching them too.

Where will you get fish and plants and snails? Where will you get sand?

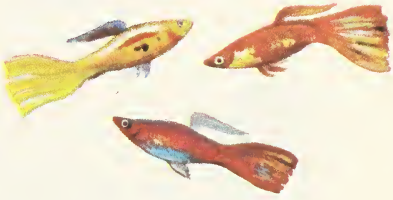
Here are some fish that you can put into your aquarium.

How are the fish alike?

How are the fish different?



Goldfish



Guppies

Zebra fish

The sand in your aquarium will have to be clean. Be sure to wash it. How will you know when the sand is clean? When the sand is clean, put it into your aquarium. Why should you use only clean sand?

Get some plants that will grow in water. Put them in the sand. Put them in carefully so that they will stay in the sand. Where can you find out about plants that will grow in an aquarium?

Now put the water into the aquarium.

Each fish will need this much water. How much water would two fish need? How much water would ten fish need?

Quart bottles

Let the water stand for a day or two. Then put the fish and snails into the water.

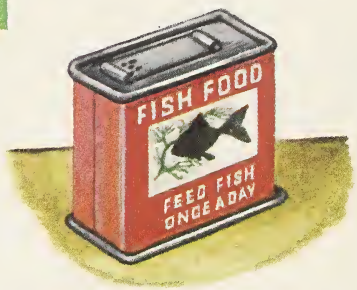
The fish will need some light. If there is too much light, little green plants that you do not want will grow. They will grow so fast that they will make the water look green.

The fish will need air just as you need air. Fish get air from the water. You must let air get into the water.

Put a cover on your aquarium. Put it on like this.

Can air get into the water?

The fish will need food. You can buy food for them in a pet shop.



Give them very little food at one time. Read the words on the box of food. Do just what they tell you to do.

The snails need food, too, but you do not have to feed them. They will find food to eat.

Watch how the snails move about in the aquarium. They are looking for food.

The snails will help keep the aquarium clean. Can you tell how? Watch the snails and you will find out.

Scientists Find Out

A scientist finds out about many things. Finding out about things is his work. A scientist may want to work alone. Sometimes many scientists work together.

Scientists find out about plants and animals.

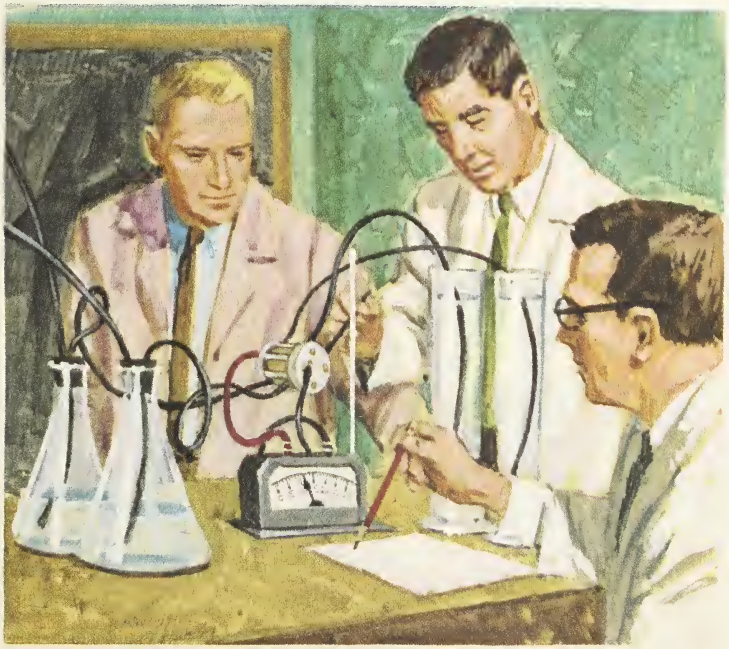
Scientists find out about people.

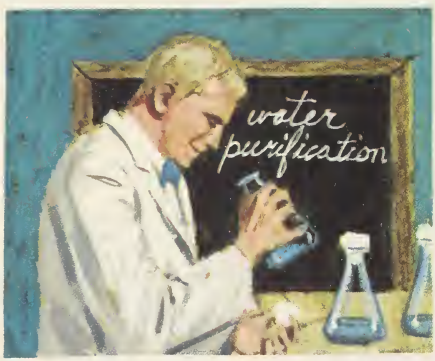
Scientists find out about the earth and the sun.

Scientists find out about heat and cold.

Scientists find out why things move and why they stop.

Can you think of other things scientists find out about?





Scientists find out about things in many ways. Some of the ways they use to find out are the same ways that you use.

Scientists find out by seeing and hearing. Scientists also find out by tasting and smelling and feeling.

Scientists find out by watching things for a long time.

Scientists find out by reading books. Who writes the books? How did the writers find out?

Scientists find out by measuring.

Can you think of other ways scientists can find out about things?

Tell the Word

A_____M

B_____Y

C_____R

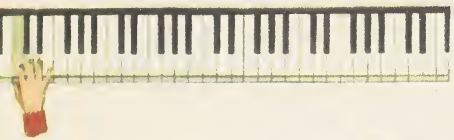
C____N

F_____S

M__H

S___L

What Do You Know?



John knows that Jane is playing the piano. How did he find out?

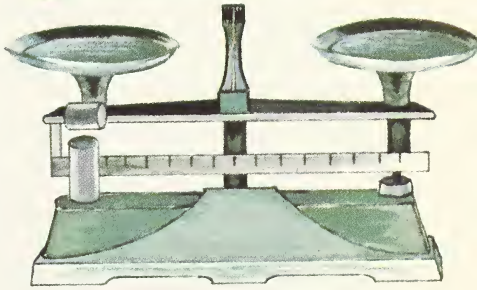
Tell how a caterpillar is not like a moth.

Which one is the butterfly? How do you know?

Tell how to make an aquarium.

Tell what things snails need.

What can you use to find out how heavy something is?



What can you use to find out how tall something is?

What can you use to find out how hot something is?

What can you use to find out how fast something is going?

2

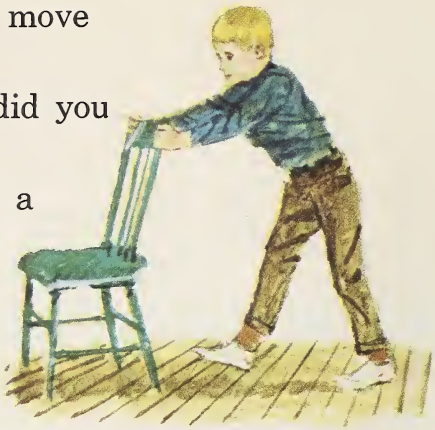
FINDING OUT ABOUT Forces

You have learned ways to find out about things. Now you can use these ways to find out about moving things. Study the picture. Tom and Jane see many different kinds of moving things. How many do you see? How do they move?

Things do not start to move by themselves.

Move a chair. What did you do to make it move?

Things need a push or a pull to make them move.



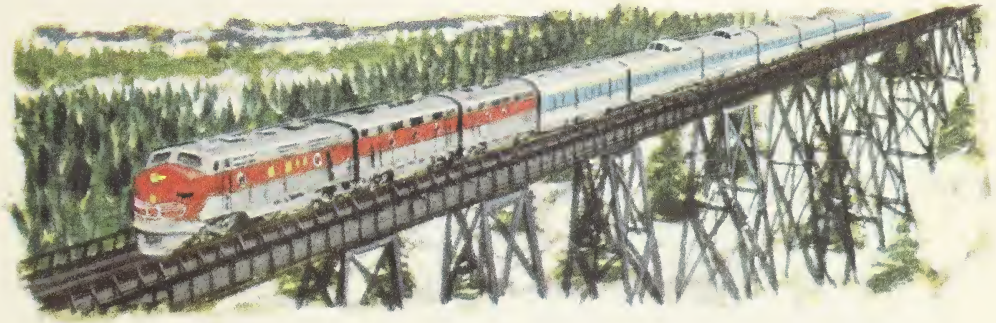
Pushes and pulls are called **forces.** Some forces come from using our body. Some forces come from other things.

What makes the broom move?

What makes the nail move?

What makes the leaves move?

What makes the train move?



What makes the stones move?

Where Will It Go?

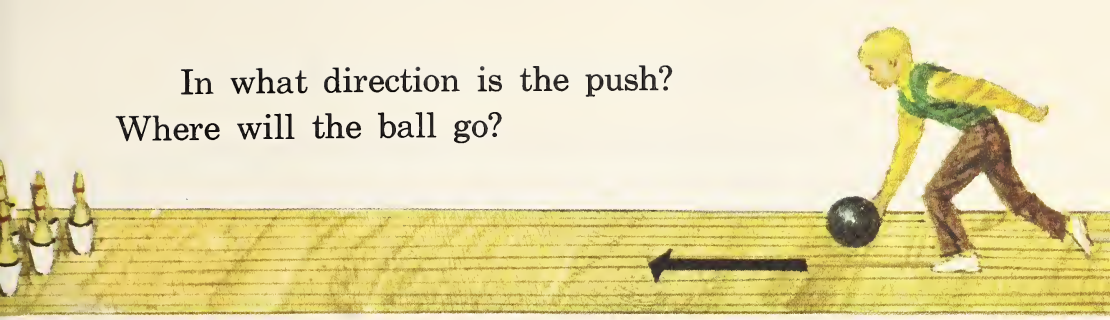
Tom wants to roll the ball through the gate.

If he pushes the ball this way, where will it go?

If he pushes the ball this way, where will it go?

How must he push the ball to make it go through the gate?

In what direction is the push?
Where will the ball go?



In what direction is the pull?
Where will the box move?

In what direction is the push?
Where will the ball go?

In what direction is the pull?
Where will the nail go?

A push or a pull is needed to start something moving. The thing will move in the direction of the push or the pull.

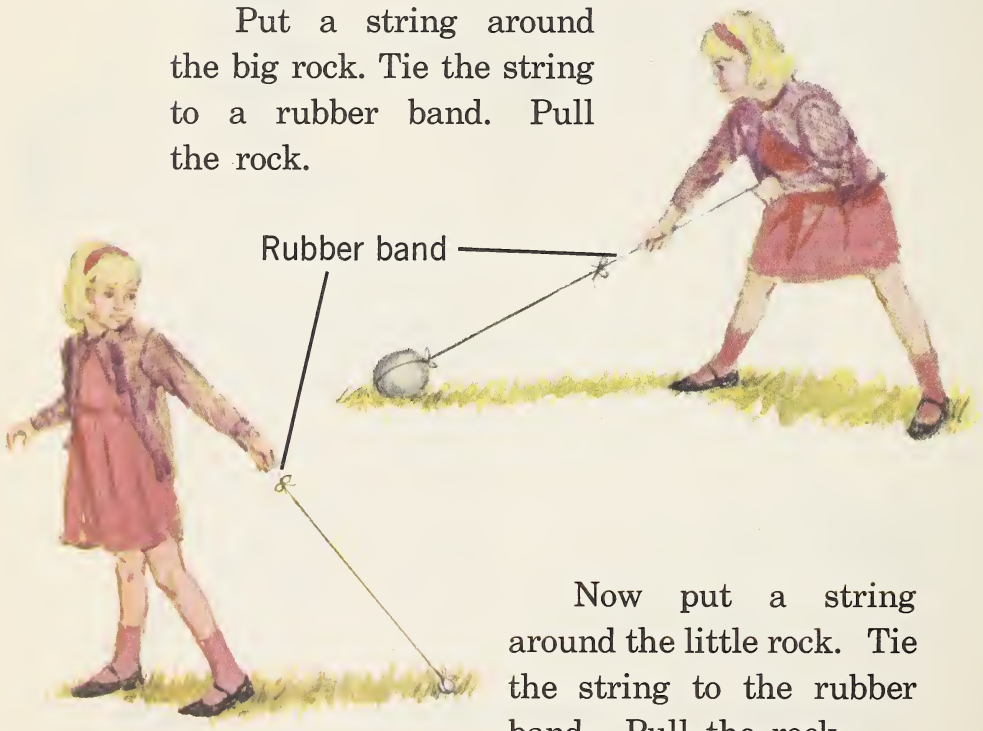
How Big a Push or a Pull?

You can push or pull hard. You can push or pull gently. Forces can be different.

When do you need a big force? When do you need a little force? You can find out.

Get a big rock and a little rock.

Put a string around the big rock. Tie the string to a rubber band. Pull the rock.

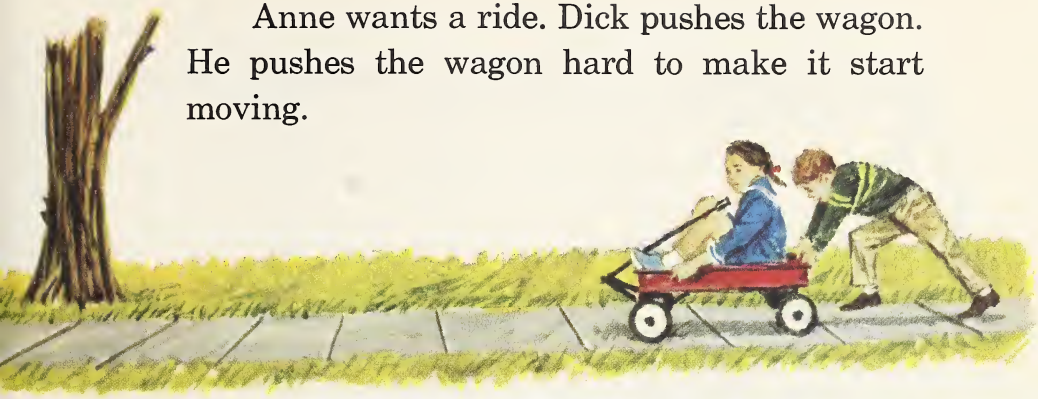


Now put a string around the little rock. Tie the string to the rubber band. Pull the rock.

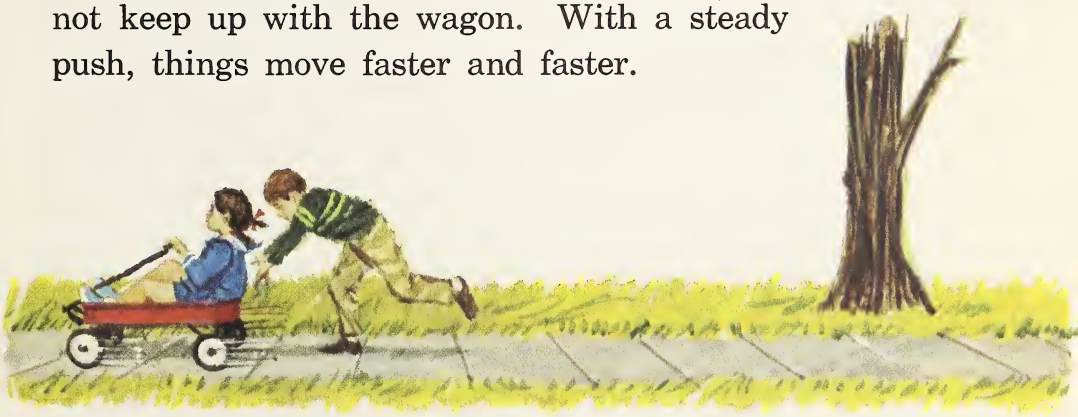
Which rock was harder to pull? When did you use more force? How could you tell?

Using a Steady Push

Anne wants a ride. Dick pushes the wagon. He pushes the wagon hard to make it start moving.



Dick keeps on pushing just as hard. The wagon begins to speed up. Soon, Dick can not keep up with the wagon. With a steady push, things move faster and faster.



Pushing Heavy and Light Things

Mary is much bigger than Jane.

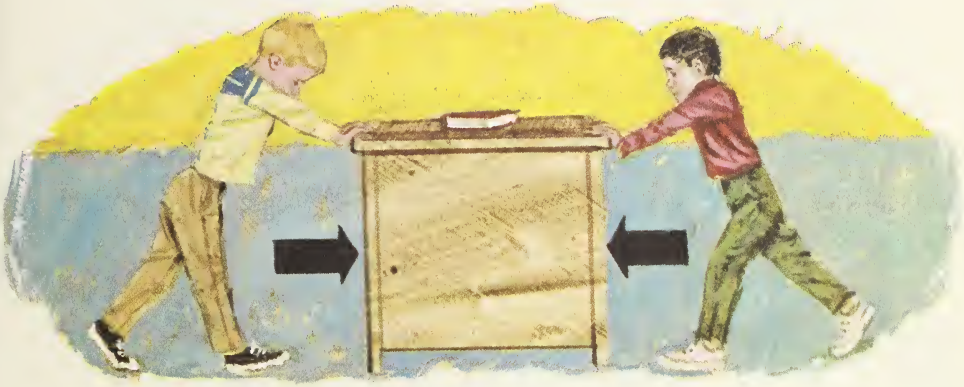
Bob is pushing Mary, and Dick is pushing Jane. Dick is pushing just as hard as Bob.

Which swing will go faster? Why?

When Forces Are the Same Size

Tom is pushing in one direction. Paul is pushing in the other direction.

Paul is pushing as hard as Tom. The forces are the same. Will the desk move?



Now Tom is pushing harder than Paul. Will the desk move? In which direction will it move?

Pushing Against a Force

The wind is blowing. Lucy tries to walk.

What will happen if the wind pushes as hard as Lucy pushes?

What will happen if the wind pushes harder than Lucy pushes?

What will happen if Lucy pushes harder than the wind pushes?

Jim and David are playing. Jim is trying to win, and David is trying to win.

What will happen if Jim pushes as hard as David?

What will happen if Jim pushes harder than David?

What will happen if David pushes harder than Jim?

Pulling Against a Force

When pulls are the same from both sides, then a thing will not move.

But if one pull is bigger, then the thing will move. Which way will it move?

Making Things Stop

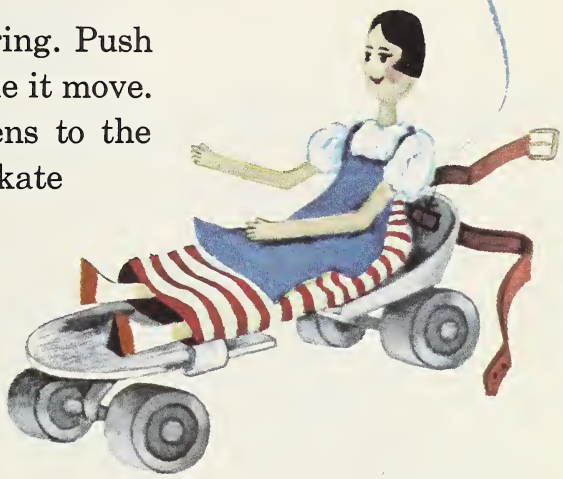
When something is moving, you need a force to stop it.

Try this.

Put a doll or a toy on a skate. Tie a string to the skate.

Hold the string. Push the skate to make it move.

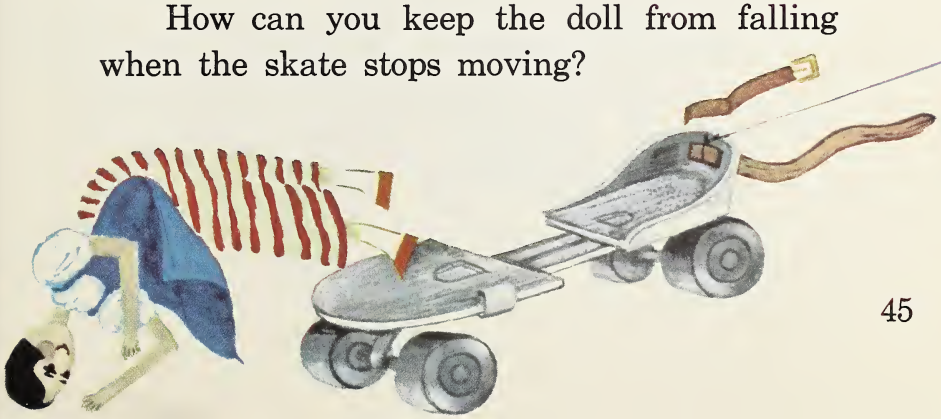
What happens to the doll when the skate starts moving?



When does the skate stop moving?

What happens to the doll when the skate stops?

How can you keep the doll from falling when the skate stops moving?



Starting Suddenly

Ted is in a bus.
He is standing up.

What will happen if the bus suddenly starts to move?

What will happen if the bus stops suddenly?
Why is it safer not to stand up in a bus?

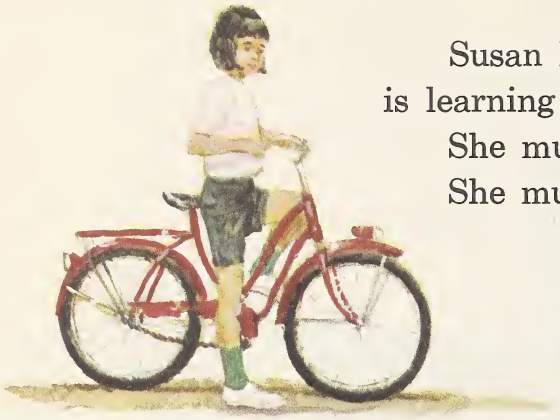
Stopping Suddenly

Linda and Peggy are riding in a car. Peggy did not put on her seat belt.

Suppose the car stops suddenly. What will happen?

How can seat belts help?

Using Wheels



Susan has a new bicyle. She is learning how to ride it.

She must learn how to start.

She must learn how to stop.

She must learn how to ride straight.

She must learn how to turn.

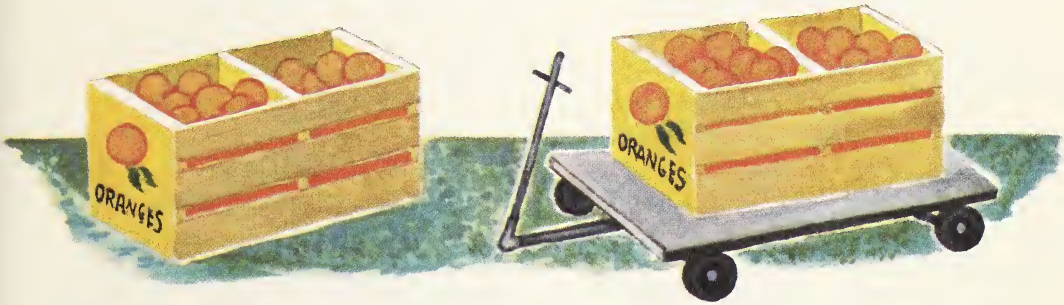
She must learn how to keep from hitting things.

How does finding out about moving things help Susan learn how to ride a bicycle?

Wheels Help Things Move

The wheels on Susan's bicycle help her to ride. Wheels can help us do other things too.

It is hard to move heavy things. It is hard to lift things up high. Wheels can help. There are different kinds of wheels.



Which box is easier to move?

How many wheels does the bicycle have?

Where is the wheel?

Pulley Wheels

A wheel like this is called a **pulley.**

Mr. Brown wants to raise the hay up high. A pulley helps him.

In which direction does Mr. Brown pull? In which direction does the hay go?

What does the pulley do?

Mr. Jackson wants to raise the flag to the top of the pole. A pulley helps him.

In which direction does Mr. Jackson pull? In which direction does the flag go?

How does the pulley help to raise the flag?

How Pulleys Work

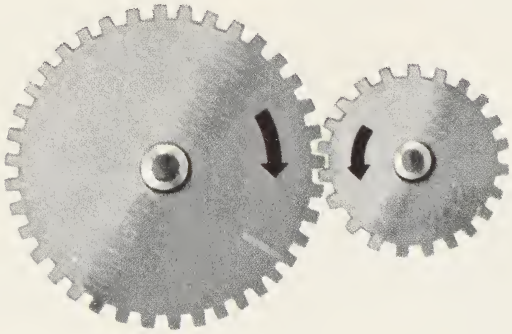
The game of Airports will help you learn how pulleys work.

Set up airports in different places in the room. Put up some lines that go on pulley wheels. You can send toy airplanes from one airport to the other on the lines.

Turning One Wheel to Move Another

A wheel that looks like this is called a **gear.**

Gear wheels can be used to turn other wheels.



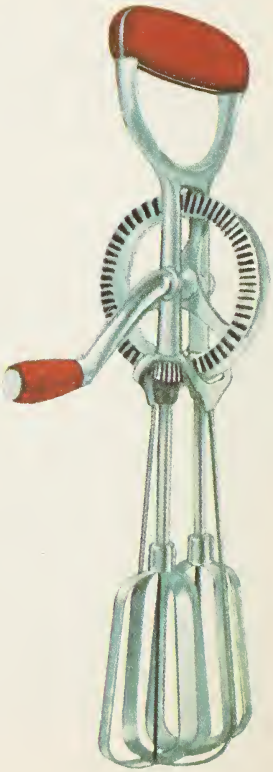
Look at this.

How many gears are there?

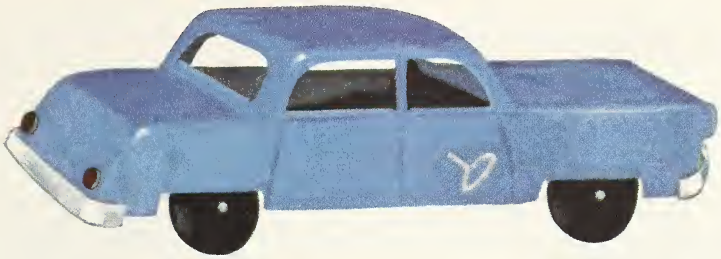
Which gear do you turn?

How do you turn it?

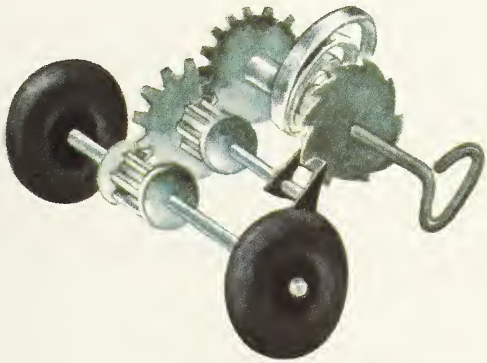
What happens when you turn it?



Look at a windup toy car. Take it apart, so you can see the inside of it. Gears help make the little car move.



First you wind a **spring.** As the spring unwinds, the gears turn. Which gear moves first? How do the gears make the car move?



Gears are used in many ways. Gears are used in real cars. They are used in clocks too. Try to get an old clock and look inside it.

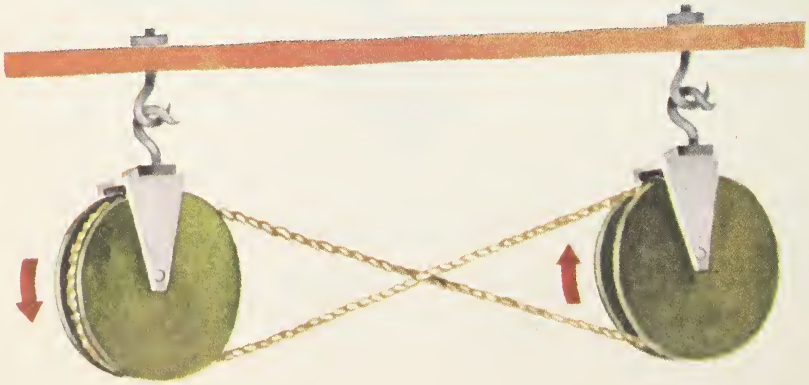
Gears are used to make one turning wheel turn another.

You can find out about another way to make turning wheels turn other wheels.

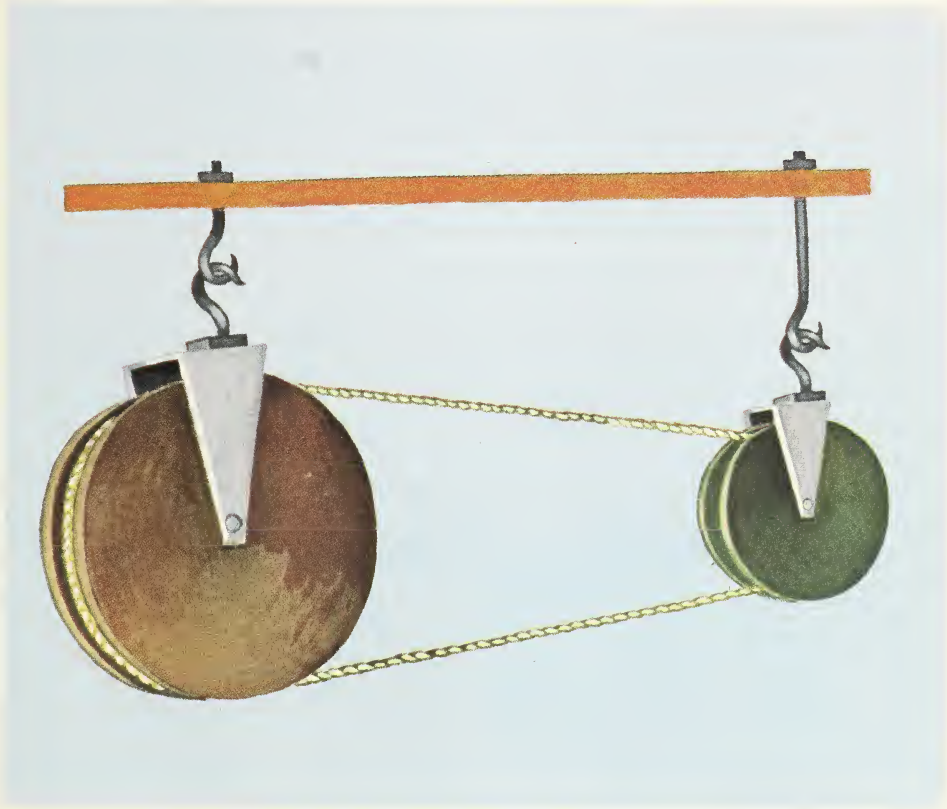
Make this.

Turn one wheel. What does the cord do? In which direction does the other wheel turn?

Change the cord like this. Turn one wheel. In which direction does the other wheel turn?



Now use one big wheel and one little wheel.
Turn the little wheel. Watch the big wheel.
Does it go as fast as the little wheel?



Turn the big wheel. Watch the little wheel.
Does it go faster than the big wheel?

A New Way of Finding Out

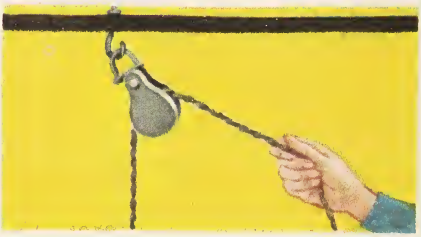
How did you find out about moving things?

You found out some things by seeing.

You found out some things by asking your teacher.

You found out some things by reading.

You used a new way of finding out, too. You tried out things to see what would happen. You tried out things with wheels and pulleys.



Scientists try out things and watch what happens. They call this doing **experiments.** An experiment is a special way of finding out about things.

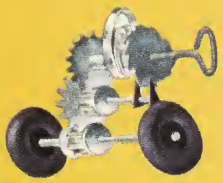
Tell the Word

E_____T

F___E

G__R

P____Y



S____G

What Do You Know?

When do things move?

In what direction do they move?

How can the boy make the wagon go faster and faster?

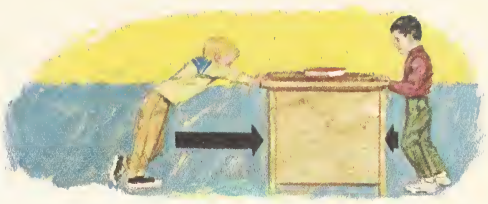
Which rock is harder to move?

Why?

Both boys are pushing with the same force. Which swing will move faster?

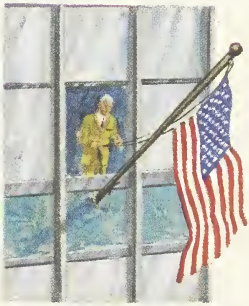
What will happen to this desk?

Why?



How can you make a thing stop moving?

What helps the man raise the flag?



Which will make you work harder? Why?

3

FINDING OUT

How Your Body Moves

You have found out what happens when things move. You have found out how wheels and pulleys are used to make things move. You can move without wheels and pulleys. You can run and jump. You will find out how.

Bones

Look at the picture on the next page. Do you know what it is? It is a **skeleton.** A skeleton is made of **bones.** You have a skeleton inside your body. You have many bones in your skeleton.

Some of your bones are small. Feel the bones in your hands. Look at the hands in the picture. The bones in your hands are small.

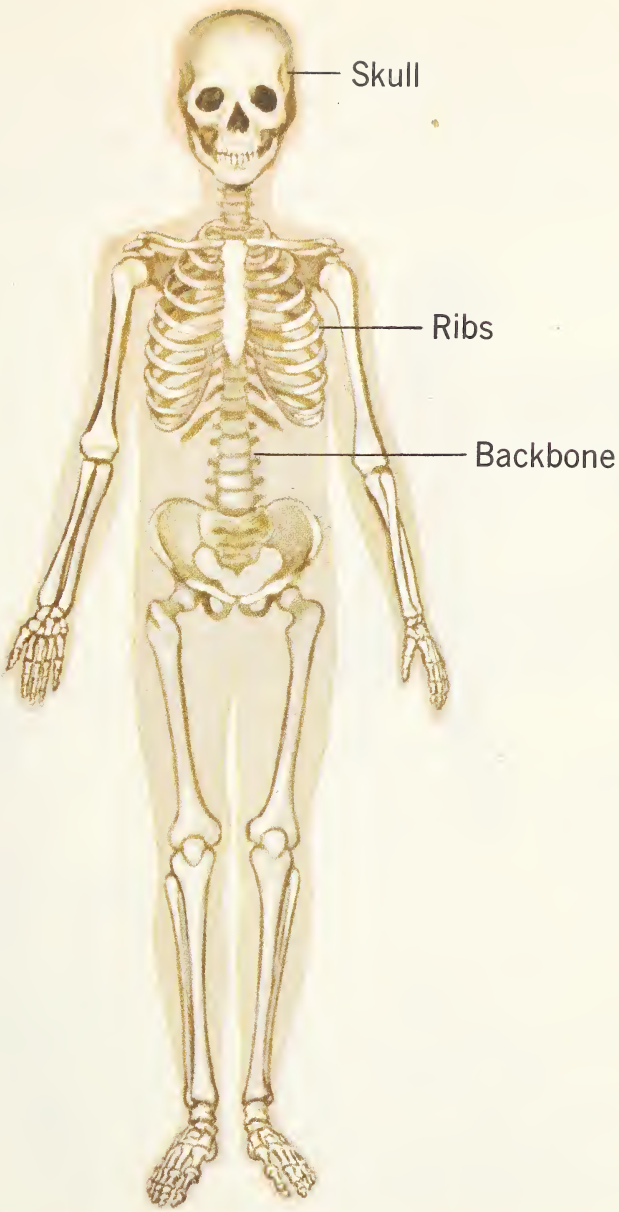
Some of your bones are big and long. Feel the bones in your legs. Look at the legs in the picture. The bones in your legs are big and long.

Your bones help give shape to your body.

Your bones help to hold your body up.

Your bones help your body to move.

Some bones cover the soft parts of your body. Can you tell where? These bones keep the soft parts from getting hurt.


Skull
Ribs
Backbone

Arm and Leg Bones

Your bones help you move in different ways. The long bones in your legs help to hold your body up. These bones are big and strong.

How do your arm and leg bones help you move?

How do your shoulder and hip bones help you move?

Hand Bones

The small bones in your hands help you do many things. Tell about the kinds of work the small bones in your fingers help you do.

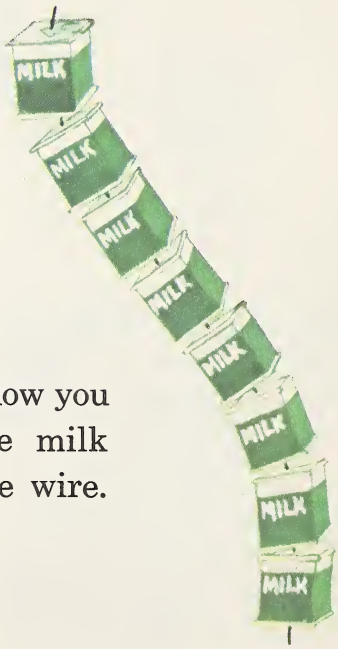
The Backbone

Feel your backbone. Look at the backbone in the picture on page 63. It is made of many small bones. It is not one long bone.

Which would help you move more easily, many small bones or one long bone? You can find out.

Get some wire, some small milk cartons, and a stick. Put the cartons on the wire like this.

See how many ways you can move the stick.



Now see how you can move the milk cartons on the wire.

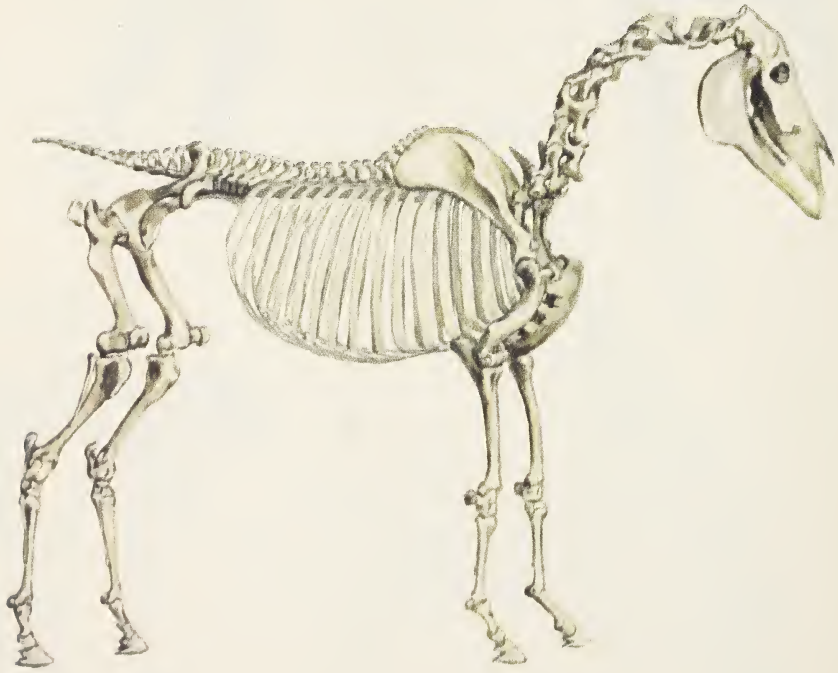
How can you move your backbone?

Here are some ways. Can you think of some other ways?

The Bones of Animals

Name some animals that have bones. Name some animals that do not have bones.

The pictures on this page and on the next page show the skeletons of some animals. Find the backbone in each skeleton.



Tell how the skeleton of each animal is like a person's skeleton. Tell how it is different. Which animal do you think has a skeleton that is most like a person's skeleton?

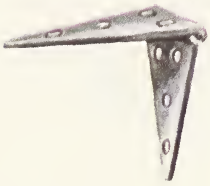
How Bones Move

The place where the end of one bone meets the end of another bone is called a **joint.**

You can move the parts of your body because your skeleton has joints. Not all of your joints are the same. There are different kinds of joints. Let us see what they are.

Bend your arm. Your elbow has a joint that lets bones move the way a door moves.

Can you think of other places in your body that have the same kind of joint your elbow has?



Would you be able to move as you do if all your joints were like the one in your elbow?

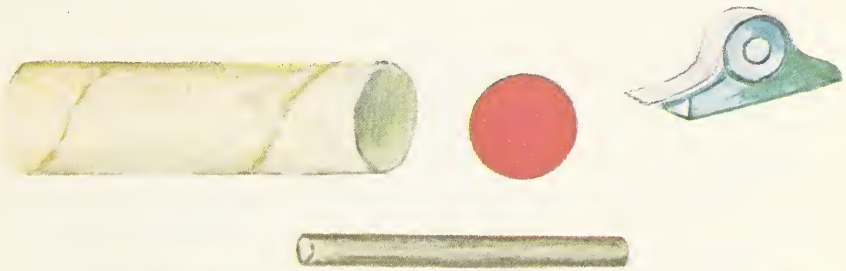
Swing your arm in a circle.

The joint between your arm and your shoulder lets you swing your arm in any direction. The joint looks like the picture on the right.

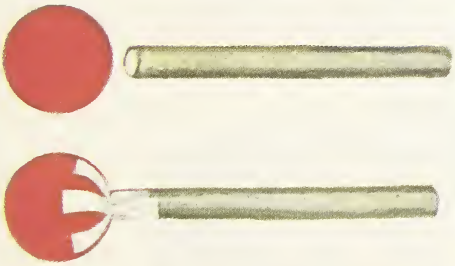
Are there other places in your body where you have joints like the one between your arm and shoulder? Look again at the picture on page 63.

You can make a joint that works like the joint between your arm and your shoulder.

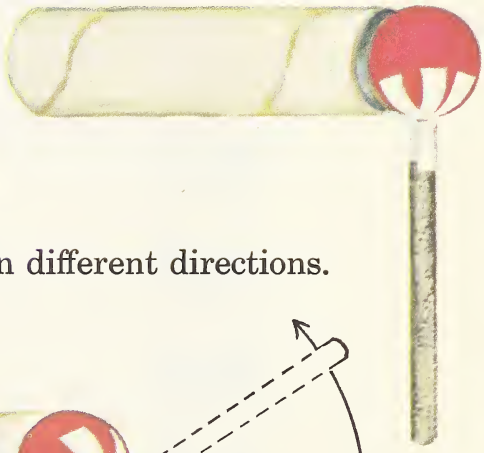
You will need these things.



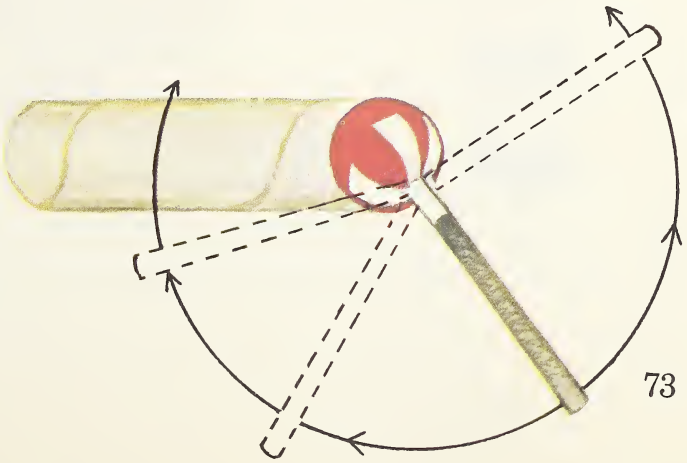
Do this.



And this.



Now move the stick in different directions.



Turn your head. Which bones move?

Some joints let bones move around on top of each other. You can find out how these joints let bones move.

Put some milk cartons on a wire again. Turn the top carton from side to side. This is like the way you turn your head. But there is a difference. Can you turn the carton all the way around? Can you turn your head all the way around?

Muscles

Peter is showing how strong he is. He bends his arm and shows a big **muscle.**

You have many muscles in your body. They are attached to your bones. Your muscles move your bones.

Feel the muscles in your arms. Where do you have muscles in your arms?

Feel the muscles in your legs. Where do you have muscles in your legs?

Some muscles are big and some muscles are small.

Different muscles move bones in different ways. Move parts of your body in different ways. Feel the muscles that move the bones.

Hold your hands on your neck the way Peter is doing. Move your head from side to side. Do you feel the muscles?

Touch your arm the way Peter is doing. Now bend your fingers. Make them straight again. Do the muscles in your arm move your fingers?

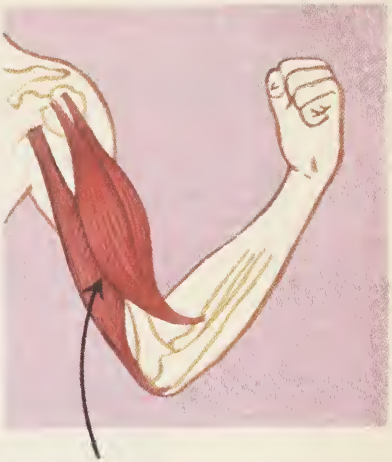
Muscles can change. You can feel and see this happen.

Feel the muscle in your arm the way Peter is doing. Now bend your arm. Do you feel the muscle get shorter and thicker? What part of the muscle gets thickest?

Make your arm straight again. Do you feel the muscle get long and narrow again?

Put your hands on your cheeks the way Peter is doing. Now smile. Do you feel your cheeks get fuller? Stop smiling. How do your cheeks feel now?

This muscle is short and thick.



But this muscle is long and narrow.

Muscles work in pairs.

Now make your arm straight again.

Which muscle is long and narrow now?

Which muscle is short and thick now?

Tell the Word

B_____E

B___S

J____S

M_____S

S_____N

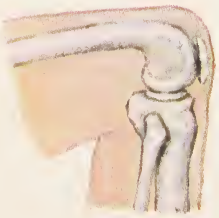
What Do You Know?

What do bones do?

How are hand bones different from leg bones?

How can your leg bones move?

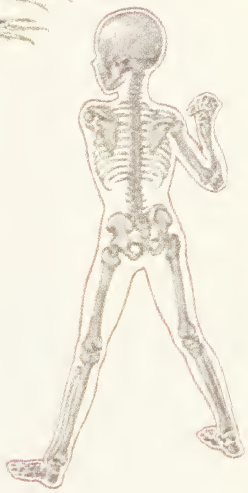
How can your finger bones move?



What do joints do?

Tell about two different kinds of joints.

Tell two ways a bird's skeleton is like your skeleton.



Tell two ways a bird's skeleton is different from your skeleton?

What do muscles do?

What happens to the muscles in your arm when you bend your arm?

4

FINDING OUT ABOUT Plants

All living things need food. A plant is a living thing that needs food. But most plants stay in one place. How do you think plants get the food they need? You will find out. You will also find out many other things about plants.

There are many kinds of plants. Some plants are very small. Some plants are very big, like trees. Some plants grow for only one year. Some plants grow for many years.

How big is this plant?

How big is this plant?

How big is this plant?

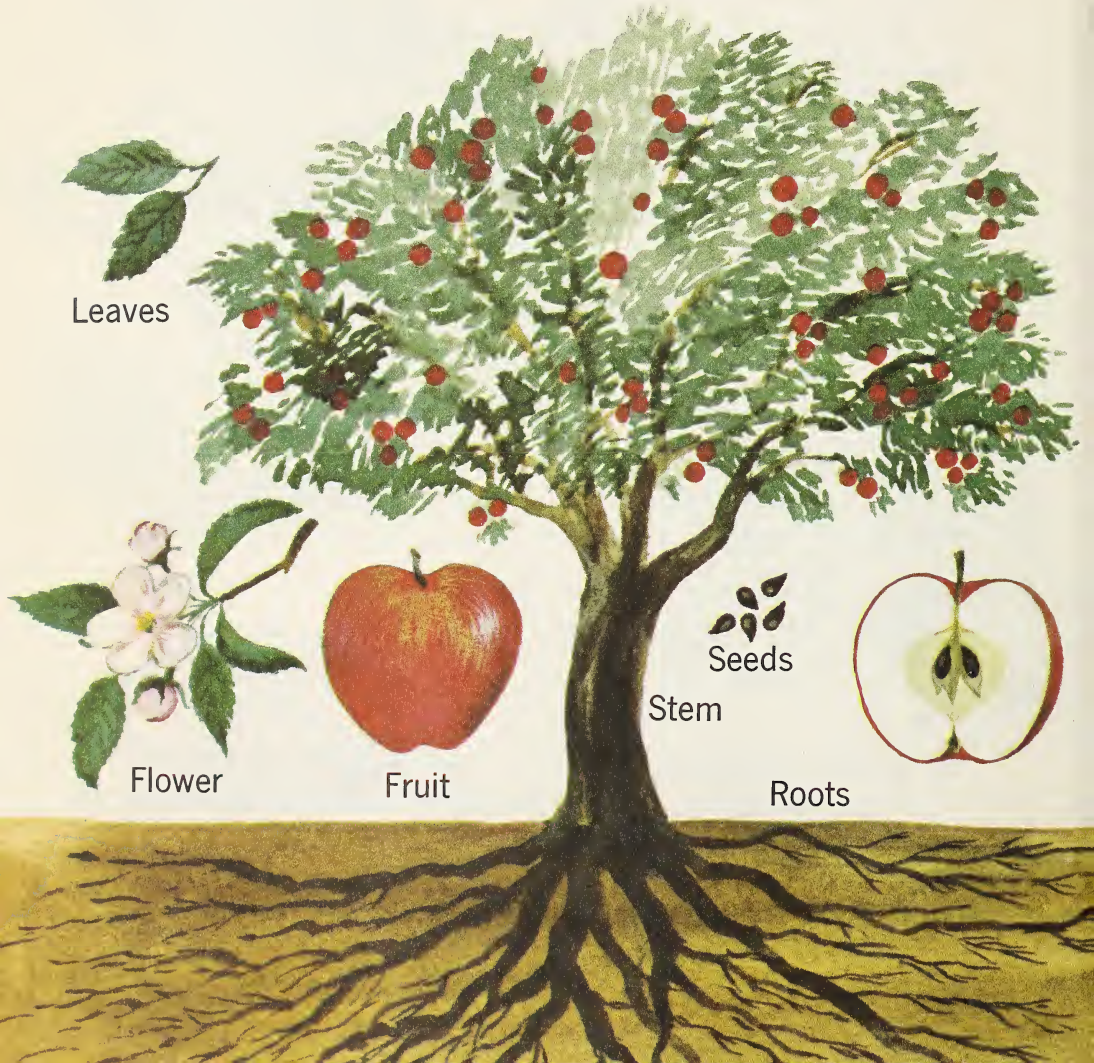
It takes many years for a tree to grow big. Many trees are older than you are. Many big trees are older than your father or mother. Some trees are even far older than your grandfather or your grandmother.

Trees get bigger each year. They grow taller as their branches grow longer. Their trunks grow wider.

The trunk of a tree will show how old it is. When a tree is cut down, you can see rings in its trunk. There is one ring for each year. You can tell how old the tree is by counting the rings.

The Parts of a Plant

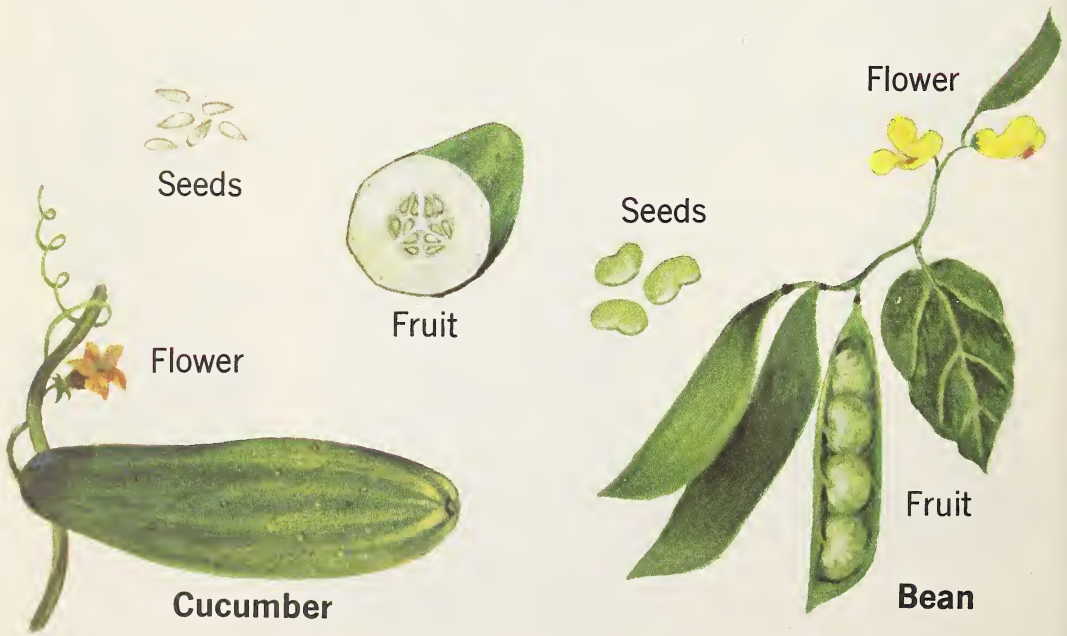
Most of the plants you know have **stems,** flowers, roots, and green leaves. A flower grows seeds. One part of the flower turns into a fruit. The new seeds are in the fruit. New plants grow from these seeds.



Find the roots of each plant.
Find the stems of each plant.
Find the leaves of each plant.
Find the flowers of each plant.

Fruits and Flowers

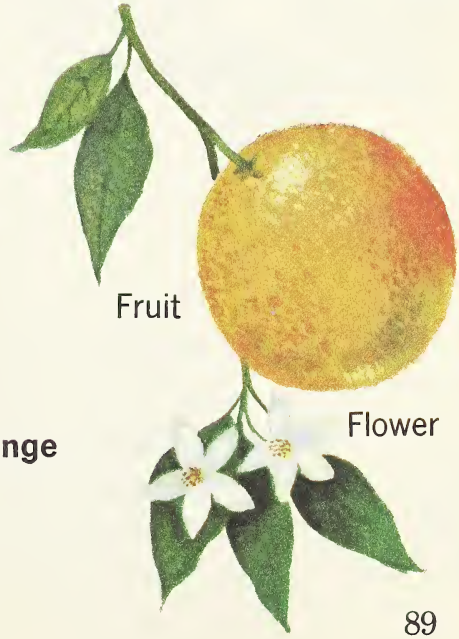
Each kind of plant has its own flowers.
Each kind of plant has its own fruit.
Each kind of flower grows its own seeds.



Dandelion

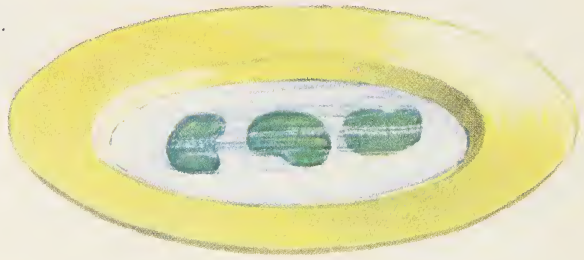
Maple

Orange



What Is in a Seed?

Put some bean seeds in water for a day.



Then open a bean seed.

Do you see the little plant? The big part of the seed is food for the little plant.

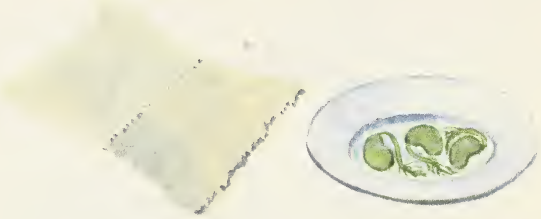
The little plant will use the food in the seed. It will grow roots and green leaves. Then it will not need the food in the seed any more. How will it get food?

What Do Green Plants Need?

Green plants can make their own food. What do they need to make food?

Do green plants need soil? You can find out.

Put wet paper towels in a dish. Put some bean seeds on the wet towel. Put a paper over the beans. Keep the towels wet every day. Watch the beans grow.



Plant some bean seeds in soil. Put water on the soil every day.

How long does it take for the little plants to come out of the soil?

Do the plants in the soil grow better than the plants in the water? What happens to the plants in the water?

Most plants need soil to make food. There are some plants that do not need soil. You used some of these plants in your aquarium.

Do green plants need light? You can find out.

Plant some grass seed in two cans of soil. Let the grass grow. Water both cans of grass.

Put a paper bag over one can of grass. This will keep out light. Put the other can where it can get light.

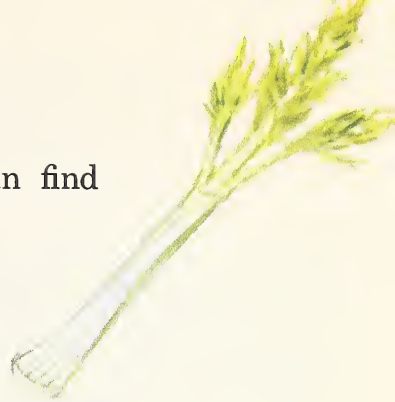
Look at both cans of grass every day. Do they look different? What happens when the grass does not get light?

Do plants need water? How can you find out? Can you tell before you read about it?

Put two other cans of grass where they can get light.

Water one can of grass. Do not water the other can of grass. Watch what happens.

How do plants get water? You can find out. You will need these things.



Do this.

And this.

Watch what happens. Can you tell where the water is?

What do you call the part of a plant that is in the soil? Do you know what roots do?

Roots take up water from the soil. The water goes up the plant in tubes.

What else do roots do for a plant?

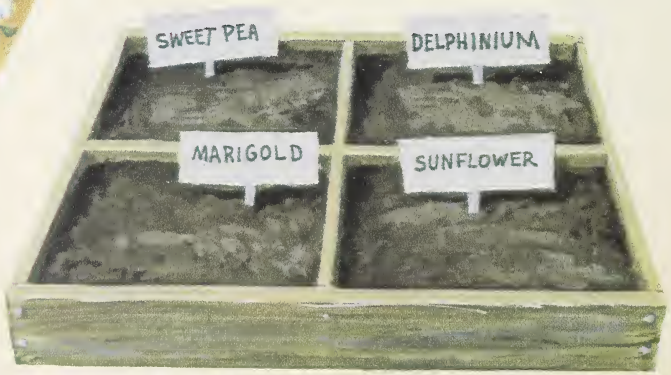
Planting Seeds

What must you do to grow plants in a garden?

Get some different kinds of seeds at a store. Look at the seeds. How are they different?

Plant some seeds in soil. The package will tell you how to plant them. Some seeds will grow a plant that you can see in a few days. Other seeds will take longer. See how long it takes for your seeds to grow.

Will every seed that you put in the soil grow into a plant? How can you find out?



You can make a chart like this to show what you find out. Make the chart large so that you can write on it.

A Weekly Review of Plant Growth

PLANT	1	2	3	4	5	6	7	8	9	10
Delphinium										
Sweet Pea										
Marigold										
Sunflower										

You have been finding out about plants in the same way that scientists find out. You have been doing experiments. Can you tell about an experiment you have done?

Seeds Travel to Different Places

Some plants grow from seeds that no one planted. How do these seeds get planted?

Seeds get to different places in different ways.

The wind blows some seeds to different places.

Water carries some seeds to different places.

Some animals put seeds into the ground. Some of these seeds grow into plants.

Look at these. There are seeds inside. How do the seeds get to different places?

Burr

Spanish nettle

Growing Plants in Other Ways

Not all plants start from seeds. Some plants start from **bulbs.**

An onion is a bulb. Cut an onion open. Look inside. You can see the part that will grow.

Put an onion in water. The water should not cover the whole onion. Watch the onion as it grows.

The bulb will grow in water for some time. What will the new plant use for food?

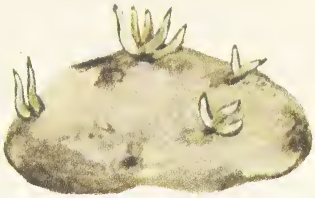
The bulb will grow better in soil. Why?

Here are plants that grow from bulbs.

Sometimes you can grow new plants from stems and leaves. These are called **cuttings.**

Try growing some plants from cuttings. Put the cuttings in water until they grow roots. Then put them into soil.

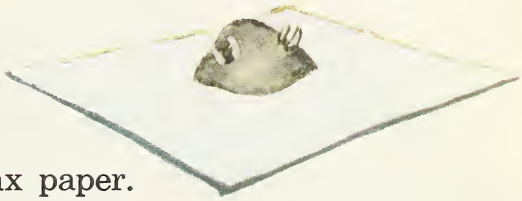
Here is another way to grow plants.



Get a potato and cut it into three pieces.

Plant one piece in soil.

Put one piece in water.



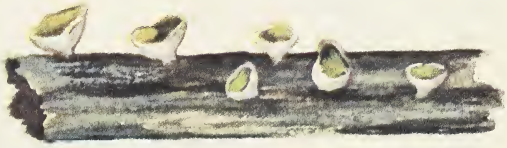
Put one piece on wax paper.

Watch what happens. Which piece grows best? Why?

Plants That Are Not Green

Some plants are not green. Plants that are not green cannot make their own food. They must get food from other things. Some of these plants grow on living things. Some grow on things that are not living.

Fairy ring



Cup fungi

Boletus

Puff balls

Have you ever seen stale bread with green spots? The spots are called **mold.** Mold is a plant. It is not a green plant. It does not make its own food. It grows by getting food from the bread.

A mold plant is so small that it is hard to see its parts. This is how it looks when you see it through a microscope. Scientists often use microscopes to study molds and other things that are hard to see.

There are many kinds of molds. You can find some of them on fruits. You can find some of them on cheese.

Tell the Word

B__B

C_____S

M__D

S__M

What Do You Know?

Where do seeds come from?

What do plants need to live?

In some of your plant experiments, the plants did not grow. Why?

How does the little plant in a seed get food?

How does the little plant in a bulb get food?

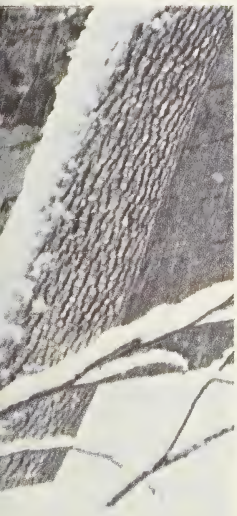
Tell three ways to grow new plants.

Tell three ways seeds can get from one place to another.

How do the roots of a plant help the plant?

How do plants that are not green get food?

How can you tell how old a tree is?



5

FINDING OUT ABOUT Heat

What happens to most plants in winter? What happens to most plants in summer? Plants need heat. We also need heat to live. Living things get heat from the sun. Without the sun's heat, nothing could live.

People learned a long, long time ago that the sun is very important. People have always wondered about the sun. They have always wanted to find out more about the sun.

Scientists have found out many things about the sun. But they still do not know everything about it. You will find out some of the things scientists know about the sun.

Can you see stars in the daytime? Yes, you can see one star in the daytime. You can see the sun. The sun is a star. Are you surprised that the sun is a star? How does the sun look different from other stars?

If you could travel to another star and look at the sun, you would see just a point of light. The sun would look like any other star. When you see it from the earth, the sun looks bigger and brighter than other stars. It looks that way because the earth is much nearer to the sun than to any other star.

The sun is very hot. It warms the earth and the things on the earth. The warm earth then makes the air around the earth warm.

Feel the ground where it is sunny. Feel the ground where it is not sunny. Where is the ground warmer?

Go back to the sunny place.

Hold your hand near the ground. Does the air feel warm? What makes the air warm? Is the air as warm as the ground?

Some places on the earth are heated more by the sun than other places. Do you know about places that are warm all the time? Do you know about places that are cold all the time?

At some times of the year, the earth gets more heat from the sun than at other times. At what time of the year is it hot where you live? When is it cold where you live?

The earth is also heated more by the sun at different times of the day. Which parts of the day are cool? Which parts are warm?

A Thermometer

How can we tell how warm the air is?

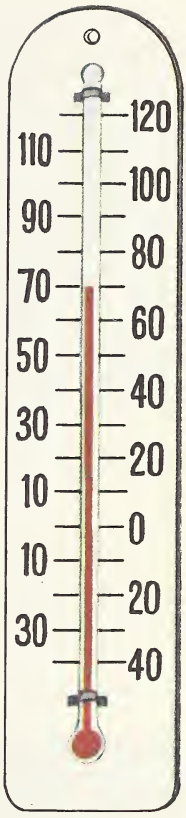
Is there a thermometer in your classroom?

Look at the colored liquid in the thermometer. It is not water. A liquid is anything you can pour. Water is a liquid, but there are other kinds of liquids too. Do you know any other liquids?

The liquid inside the thermometer goes up and down. When does it go up? When does it go down?

A thermometer is marked in **degrees.** Look at the thermometer on this page. How high is the liquid?

Temperature is how hot or how cold something is. A thermometer measures the temperature.



How Much Warmer Is It in Sunlight?

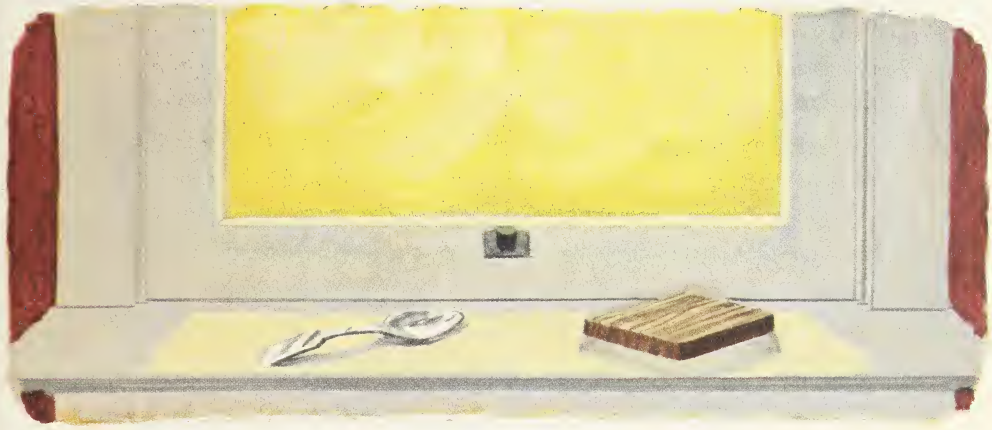
Put one thermometer where the sun will shine on it.

Put one thermometer where the sun will not shine on it.

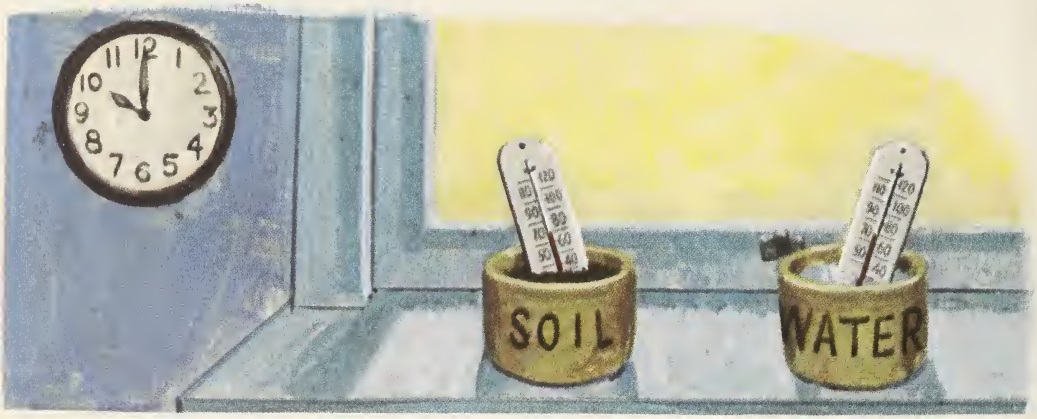
After a while, look at the thermometers. Is it hotter in the sun? How much hotter is it in the sun?

Some things feel warmer than others when the sun shines on them.

Put a spoon and a piece of wood in a sunny place. Let them stay there for some time. Then feel them. Which feels warmer?

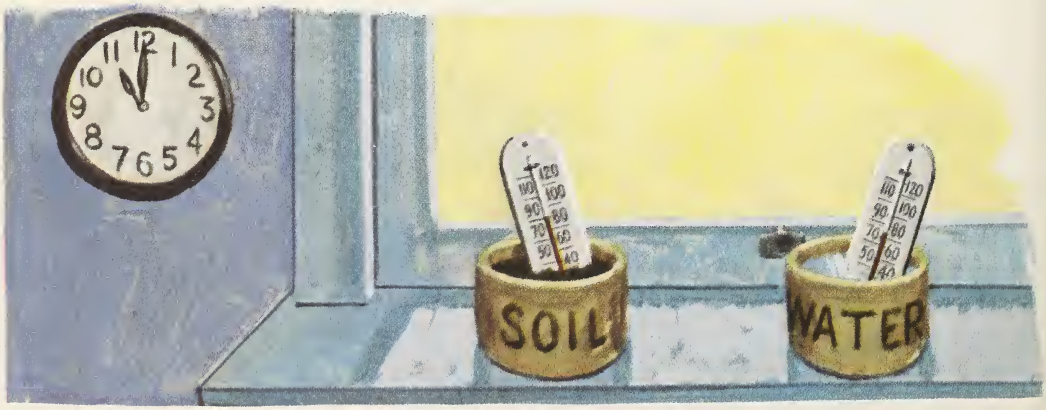


Here are some other things you can try. Which things feel warmer after they are in the sun for a while?



Some things get warm faster than other things.

Put some soil and some water in a sunny place. Put thermometers in the soil and in the water. Watch the thermometers. Which warms up sooner, the soil or the water?



When Things Are Heated or Cooled

How do things change when they are heated or cooled? Your teacher will help you find out.

She will get this. And this.

She will show that the nail fits tightly into the washer.

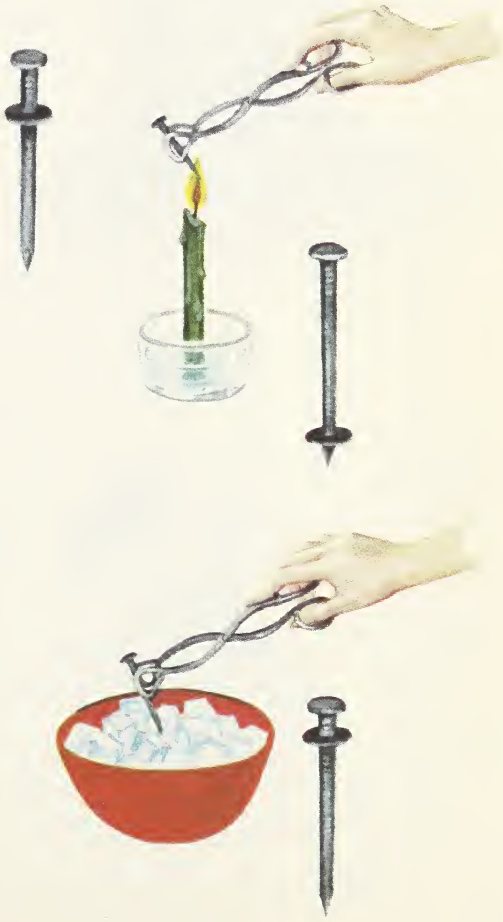
Watch her heat the nail this way. Will the nail now fit into the washer?

What happens when the teacher puts the hot nail into ice water?

Will the nail fit into the washer now?

Things get bigger when they are heated. They take up more room.

Most things become smaller when they are cooled. Then they take up less room.



Try this. Watch what happens to the balloon.

Now do this. Watch what happens to the balloon.

How does air change when it is heated?

How does air change when it is cooled? You can find out.

Do you remember what a liquid is?

How does a liquid change when it is heated? How does a liquid change when it is cooled? You can find out.

Color some water and try this. Watch what happens to the water.

Now do this. What happens to the water?

A liquid takes up more room when it is heated.

A liquid takes up less room when it is cooled.

Most things get smaller when they are cooled. But water is different when it turns to ice. You can find out what happens when water turns to ice.

Fill a can with water.

Do this. Wait until the water turns to ice.

Look at the can. Does the ice take up less room? Does the ice take up more room?

Sometimes pipes break when they get very cold. Ice breaks them. Do you know why?

Heat Goes to Cooler Things

Put some very hot water into a pan. Put a thermometer into the water. How hot is the water?

Put the pan on a cool table. Wait ten minutes. Look at the thermometer again. What has happened? Where did the heat go?

Lift the pan. Feel the table where it was. Some of the heat went from the warm pan to the cool table. Some of the heat went into the air, because the air was cooler than the pan.

Heat goes from warm things to cool things. We can use hot things to make cold things warmer. Can you think of some ways?

Put some ice into warm water. What happens to the ice? What happens to the water? Where did the heat of the water go? How can you tell?

Put a spoon into some hot water. Hold the spoon. What do you feel?

Put the spoon into ice water. Hold the spoon. What do you feel?

Put a stick into hot water. Does it get as hot as the spoon?

Put a stick into ice water. Does it get as cold as the spoon?

Do you remember what happened when you put a spoon and a stick in sunlight?

Fire

When things get very hot, they burn. When things burn quickly, you can sometimes see a fire.

Here are some of the ways we use fire. Can you think of other ways?

What Makes Fire Burn?

In one class, the teacher did an experiment to find out what makes fire burn.

She poured some water around a candle. Then she lit the candle. Next, she put a small glass over the candle. Can you tell what happened? What do the glass and water do?

Then the teacher used a big glass. Do you think the candle burned longer? Why?

You should not do experiments with fire unless the teacher or another grownup is watching you. Do you know why?

This fire will burn better now. Why?

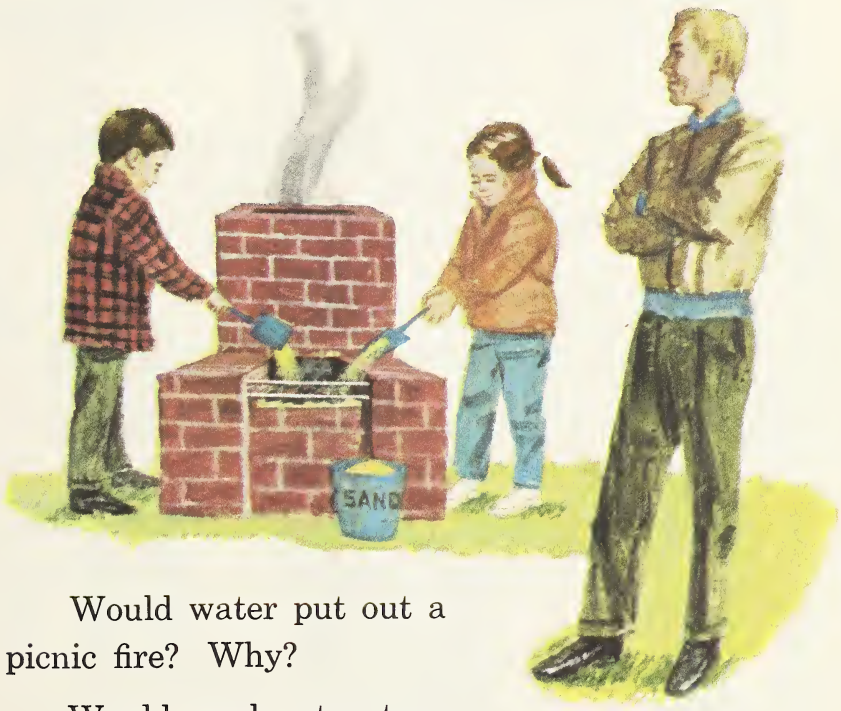
This fire will go out. Why?

Being Careful with Fire

Fire helps us in many ways. But fire can be dangerous, too. Can you tell how?

There are ways of being careful with fire. How would you be careful when using fire?

A fire at a picnic is fun. When it is time to go home, you must make sure the fire is out. Then it will not set fire to other things.



Would water put out a picnic fire? Why?

Would sand put out a picnic fire? Why?

This fire helps keep the yard clean. How is the fire made safe to use?

Matches help build a fire when you need one. What kind of matches are best to use? Where are safe places to keep matches?

Sometimes you need to use things that get very hot. How can you use these things safely?

Here are some things to remember about being careful with fire.

Do not play with matches or with fire.

Do not build a fire if there is no grownup to watch you.

Sometimes people's clothes catch fire. When this happens, the best thing to do is to roll in a blanket or rug. Why would this put out the fire?

Sometimes a fire starts inside the house. Do you know some ways this could happen? If a fire starts in your house, get out of the house as fast as you can! Then get help. Do you know how to get help if there is a fire?

Here are three ways to get help.

What Makes Your Body Warm?

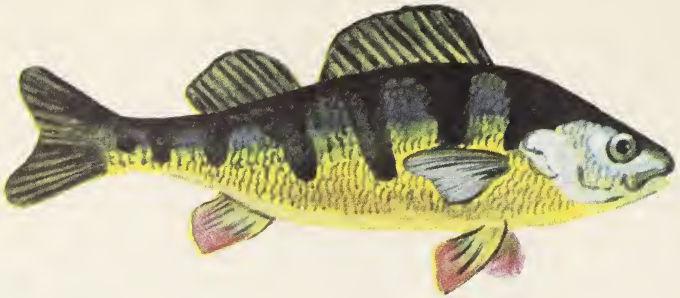
Your body makes heat all the time. It makes heat by burning food. This burning is a slow kind of burning. There is no fire.

When someone takes your temperature, he is measuring how warm your body is. If your body temperature is more than 100 degrees, you have a **fever.** Did you ever have a fever? How did you feel?

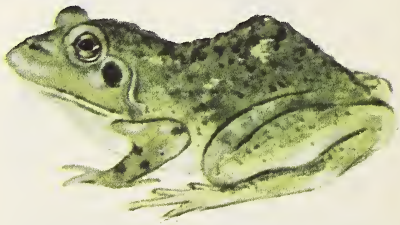
If your body temperature is less than 98 degrees, you may feel sick, too. You may feel cold. You may not feel like doing anything.

Your temperature stays about the same all the time when you are well. If your temperature changes only a few degrees, you may feel sick.

Some animals have temperatures that stay about the same. These animals are called **warm-blooded animals.** Here are some warm-blooded animals. Can you name them?



Some animals have temperatures that keep changing. When the air or the water is cold, their temperature goes down. When the air or the water is warm, their temperature goes up. These animals are called **cold-blooded animals.** Here are some cold-blooded animals. Can you name them?



How the Body Loses Heat

Look at the thermometer in the room. What is the temperature of the air? What is your body temperature? You know that heat goes to cooler things. Where will some of the heat from your body go?

Sometimes the air around you is very cold. Then heat goes from your body to the air too fast. How will you feel?

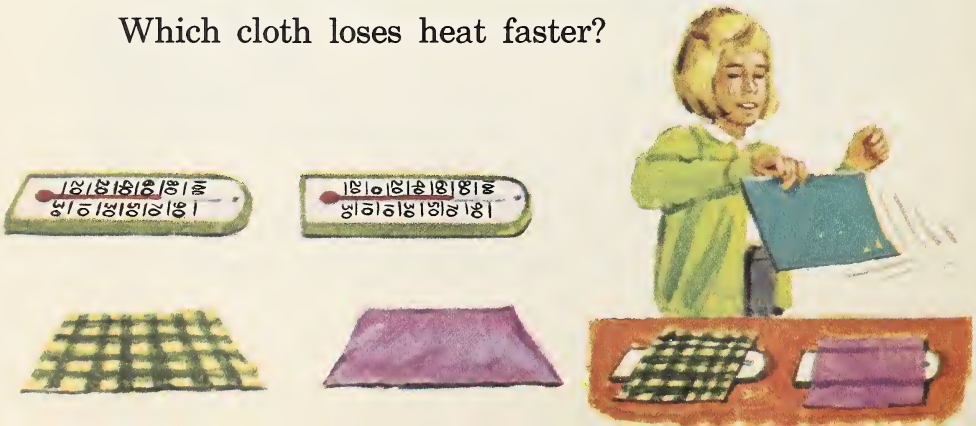
Sometimes you go into cold water. What happens when you stay in the cold water?

Sometimes your clothes get wet. You feel cold. You can find out why.

Get two small pieces of cloth and two thermometers.

Wet one piece of cloth. Put the wet cloth on one thermometer. Put the dry cloth on the other thermometer.

Fan both thermometers. Watch them. Which cloth loses heat faster?



Here are some things you can do when you feel cold.

This will help you keep warm. Your body uses food faster when you run and play. Your body makes more heat. You will feel warmer.

This will help you to keep warm. The heater is warmer than your body. Where will some of the heat from the heater go?

If you put on more clothes, your body will not lose heat so fast. You will feel warmer.

You do not need heavy clothes when you are running and playing. After you stop playing, your body may lose heat fast. Your body also loses heat fast when you are sweating. Then you need to put on more clothes. The clothes will keep your body from losing heat too fast.

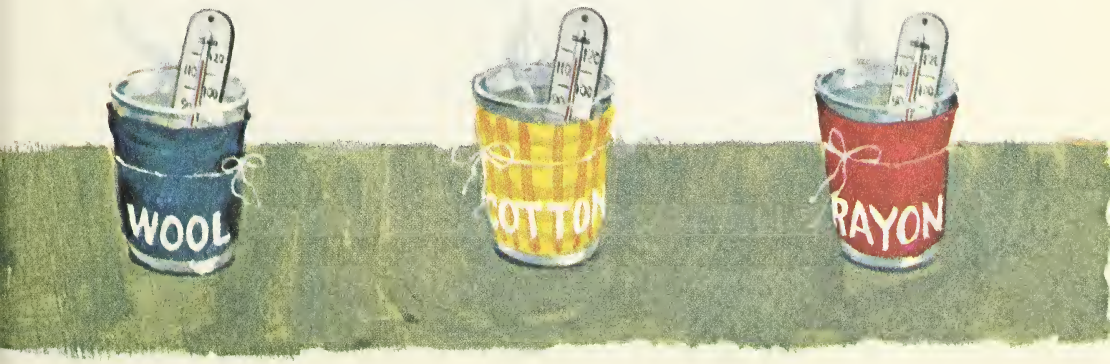
How do you feel when your body loses heat too fast? If this happens, you may get sick. Do you know why?

Kinds of Clothes

Clothes help you keep warm. You can find out what kinds of clothes help most.

Get three glasses and three different kinds of cloth. Make sure the cloths are all the same size. Wrap a different kind of cloth around each glass and tie it with a string.

Put hot water into each glass. Make sure the temperature of the water is the same in all three glasses. Use a thermometer to measure the temperature.

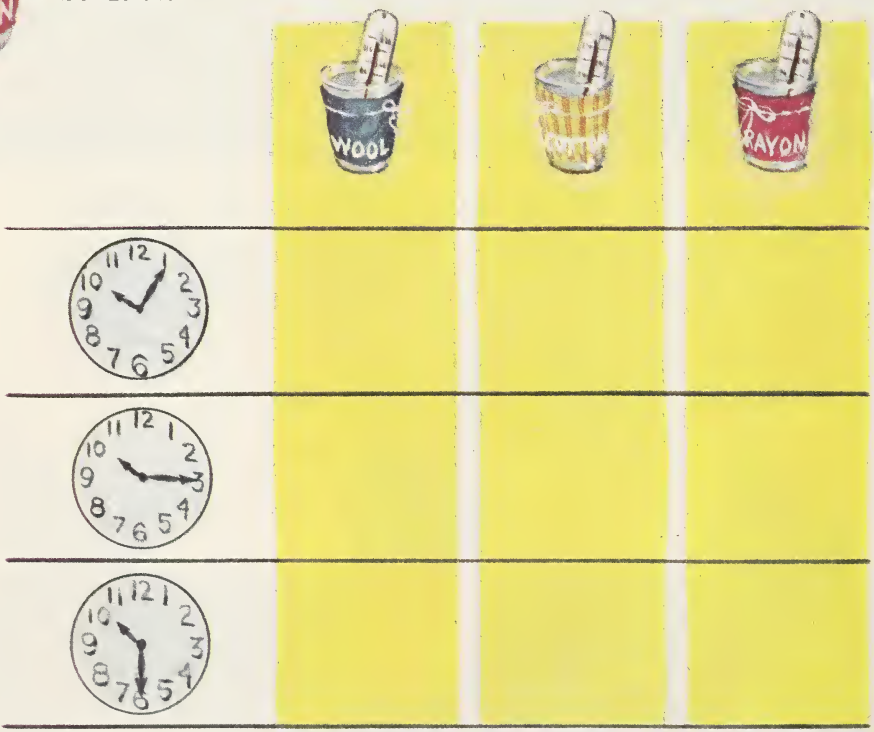


Cover the glasses.

Wait five minutes. Measure the water's temperature again. Then wait ten minutes. Measure the temperature in the glasses again. Now wait fifteen minutes. Again measure the temperature of the water.

You can make a chart like this to show what you find out.

Which cloth helped keep the water warmest? Clothing made from this cloth helps you keep warm. Your body will not lose heat so fast.



Does the color of clothes make a difference? You can find out.

Get a piece of black cloth and a piece of white cloth. Both pieces should be the same kind of cloth. Why?

Put each piece of cloth on a thermometer. Put the thermometers in the sun. In a little while look at the thermometers. Did anything happen?

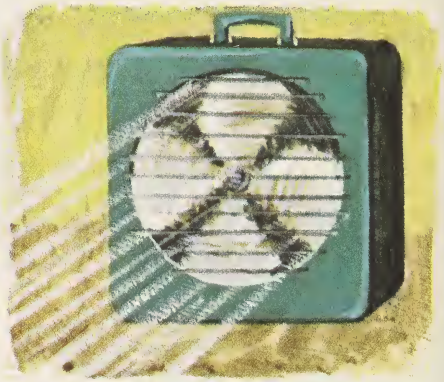
Which cloth would make you feel warmer?
Which cloth would make you feel cooler?

Keeping Cool

Sometimes the air around you is very warm. Your body does not lose heat fast enough. How do you feel then?

There are things you can do to feel cooler.

Why will you feel cooler here?



How does this help you feel cooler?

Who do you think feels cooler? Why?

Who do you think feels cooler? Why?

How Animals Keep Warm

When it is cold, you can put on more clothes to keep warm. What can a dog do? What can a cat do?

Some animals go to warm places in the winter.

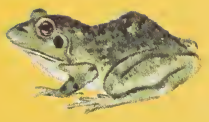
Some animals stay in their homes all winter. They keep warm there. They come out when it is warm again, in the spring.

The fur of some animals gets thicker and longer when the days get cold. These animals lose their heavy fur in the spring.

How Animals Keep Cool

Animals need ways of keeping cool, too. What are these animals doing?

Tell the Word

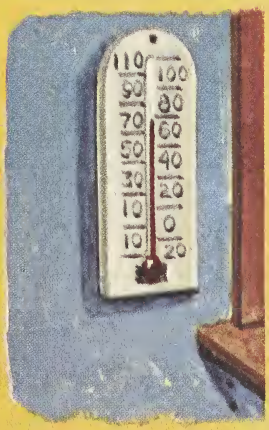


C__D-B_____D
ANIMALS

W__M-B_____D
ANIMALS

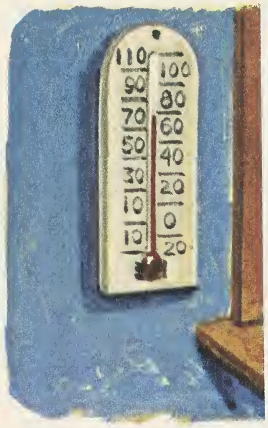
F___R

T_________E



D_____S

What Do You Know?



How does the earth get warm?

How can we measure how warm something is?

What temperature does this thermometer show?

Why can we use hot things to make cold things warmer?

What happens to most things when they are heated?

What happens to most things when they are cooled?

What makes your body warm?

Why doesn't your body get too warm?

How does a person feel if his temperature goes up?

How does a person feel if his temperature goes down?

How can you get warm when you feel cold?

Which coat will keep you warmer?

How can you keep cool on a hot day?

How do animals keep warm?

How do animals keep cool?

6

FINDING OUT ABOUT Feelings

Look at the faces of the boys and girls. Do some seem happy? Do some of them seem scared? Sometimes you feel happy, and sometimes you feel scared. What other ways do you feel? You will read about the ways people feel.

Being Afraid

Everybody is afraid sometimes. People are afraid of different things.

Sometimes people are afraid of things that are really dangerous.

Sometimes people are afraid of things that will not hurt them.

Are you afraid of lightning storms? A lightning storm can be dangerous. There are ways to be safe in a storm. Here are some of the ways.

Do not stand under trees when there is a storm.

Do not go swimming when there is a storm.

Stay away from the windows if you are inside the house.

Are you afraid of water? There are ways to be safe in the water.

One thing you can do is to learn how to swim. Here are some things to remember.

Do not go into water that is over your head.

Never go into the water if there is no grownup nearby.

Sometimes people are afraid of things they do not know much about. Finding out about things helps them not to feel afraid.

Jack was afraid of snakes. He thought that all snakes were dangerous. He did not know that most snakes would not hurt him.

Then Mr. Rodman moved next door to Jack.

Mr. Rodman had some pet snakes. He helped Jack find out about the snakes that are dangerous and the snakes that are not dangerous.

Jack watched the pet snakes. He held the snakes and touched them. He is not afraid of snakes now.

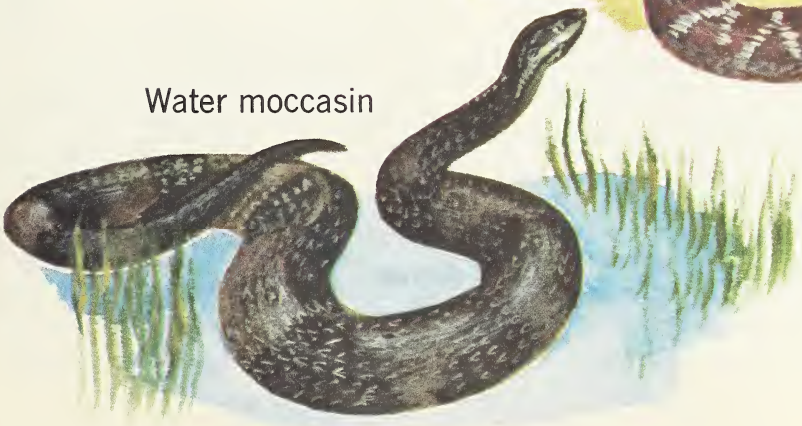
Coral snake

Copperhead

These are the only snakes in the United States that are dangerous. Have you ever seen any of them? Are there any where you live?

Rattlesnake

Water moccasin



Sometimes people are afraid of what other people will think about them. Sometimes they are afraid other people will laugh at them.

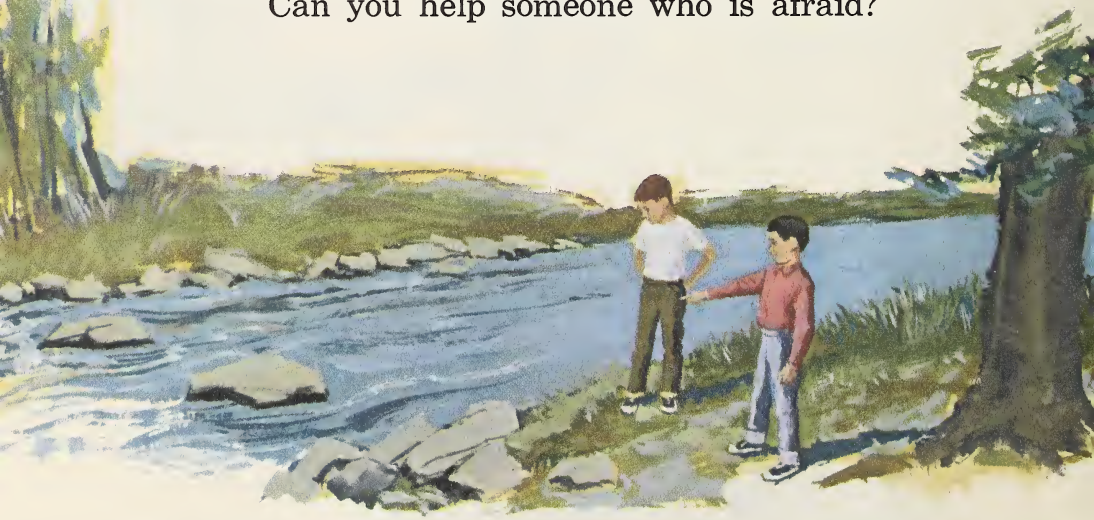
Tom dared Ted to jump across the water. Ted cannot swim and the water is deep. Ted is afraid to jump. He is also afraid that Tom will laugh at him. Maybe Tom will tell other boys and they will laugh too.

The best thing for Ted to do is to say, "Tom, I don't want to jump." Why?

Why do you think people dare other people? Do you think people who dare other people are afraid themselves?

Is it fair to laugh at someone because he is afraid?

Can you help someone who is afraid?



Being Angry

Everybody gets angry sometimes. People get angry about different things. People show they are angry in different ways.

Nancy's mother scolded her. Nobody likes to be scolded. Nancy gets angry when she is scolded. She breaks things when she gets angry. Will this help? What will happen next? What can Nancy do?

Why is Tim angry? What is he doing? Will this help? Will the baby understand why Tim is angry? What can Tim do?

Look at the pictures.
How are they different?

Will the same thing make you angrier at some times than at other times?

Do you get angrier when you are tired?
Do you get angrier when you are hungry?
Do you get angrier when you are not well?
Do you get angrier when you are unhappy?

What can you do when you get angry?

Sometimes you will feel better if you talk to another person about your angry feelings. You can talk things over with your mother or your father. You can talk things over with your teacher or with a friend.

Sometimes you can show that you are angry in ways that will not hurt anyone. Can you think of some ways?

Sometimes, if you think carefully about why you are angry, you may feel better. Then you will not do things that are not fair to other people. You may feel less angry.

Losing and Winning

Mary's foot was on a line. She moved back. Judy saw her. She said, "Mary, you are out."

Mary kept on jumping and would not stop. Judy said, "Stop, Mary!" She hit Mary to make her stop.

Mary got angry. She would not play anymore. Now she is sitting on the grass and will not talk to anyone.

Why didn't Mary want to stop?

Why should Mary learn to stop when she is out?

Did Judy help Mary by hitting her? How could Judy help Mary?

These boys are running a race. Tom is running the fastest. Tom will win.

When Bill saw that Tom would win, Bill stopped trying. Bill said he did not want to run.

Jack saw Tom winning. But Jack ran as fast as he could.

Why do you think Bill stopped?

Why do you think Jack kept on running?

How can Bill learn to keep on trying?

Some children are more unhappy than others when they lose. It takes a long time for them to learn that losing is part of the game. But they can learn if they try.

Jim hit the ball. He ran and was tagged. Jim thought he was safe. The boys said he was out.

Jim is angry. It is hard to lose in a game.

He is going home. He is taking his ball and bat with him. The other boys cannot play now.

Why do you think Jim did this? What else could he have done?

Playing a game with others can be fun. But learning to lose is hard. Learning to win is hard, too. Can you tell why?

Feelings Can Change Thinking

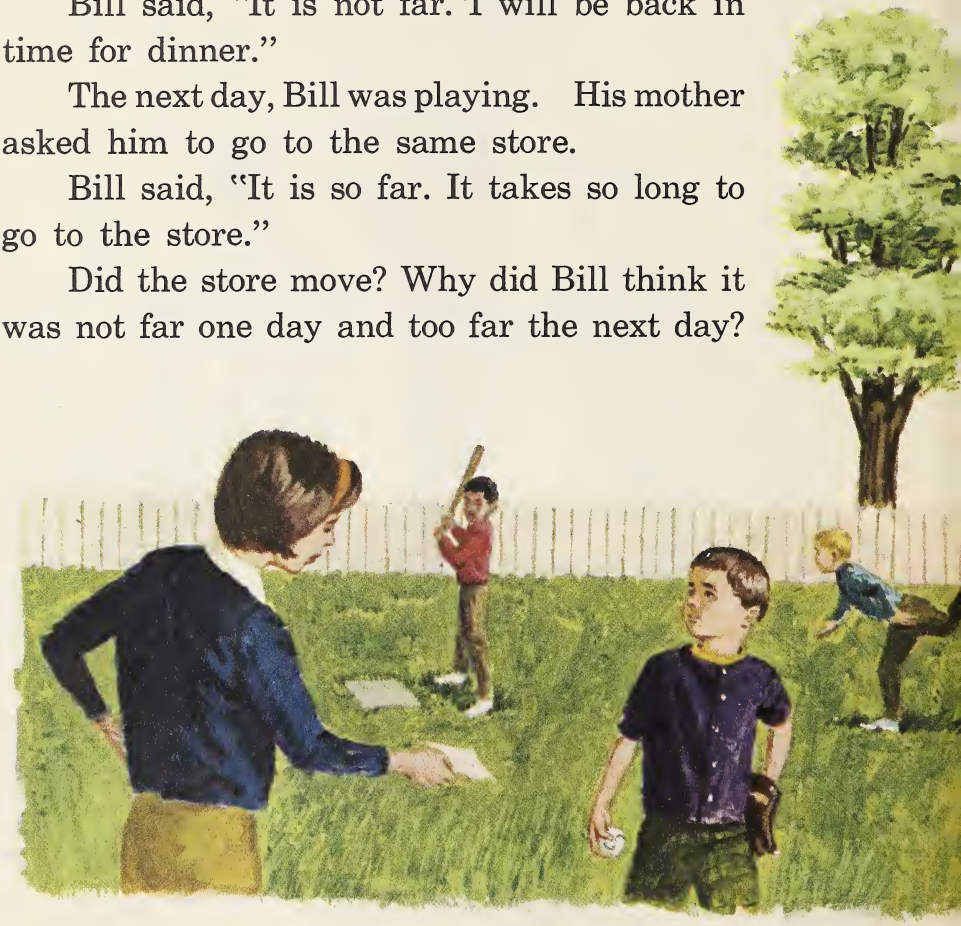
Bill had some pennies. He wanted to get candy at the store. His mother said, "It is too late. Dinner is almost ready. It is too far to go now."

Bill said, "It is not far. I will be back in time for dinner."

The next day, Bill was playing. His mother asked him to go to the same store.

Bill said, "It is so far. It takes so long to go to the store."

Did the store move? Why did Bill think it was not far one day and too far the next day?



Tell the Word

H___Y

S_D

A___Y

S___Y

H_T

C__D

What Do You Know?

Why are people sometimes afraid of things that will not hurt them? What can people do so they will not be afraid?

What should you do when you are afraid of something that is dangerous?

Why do people do dangerous things when someone says, "I dare you"?

Tell some ways that people show that they are angry.

What are some things you can do to feel less angry?

What do some children do when they lose a game?

How can someone who wins a game help someone who loses?

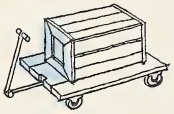
Do You Remember?

You can find out many things about the world in which you live. You can find out by

and and and

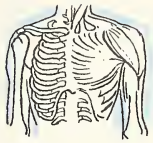
and .

You have already found out about forces.

A force is a or a . Sometimes only a small force is needed to move something. But other times it is not easy to move something, even if you push or pull very hard.  can often help you to move something. A can sometimes help you to move something. Wheels and pulleys are two things that make it easier to move some things.

There are no wheels or pulleys in your body. Your body has other ways to move about.

Your and help you to move.

You have bones and muscles in your  ,

in your , in your ,

and even in your . Because you are able to move about, your body can get all of the food that it needs.

A does not have any wheels or pulleys inside it. A green plant does not have any bones or muscles. A green plant does not need to move about to get its food. It can make its own food. Green plants can make food from the air and and sunlight.

Some plants are not green. A is not a green plant. A mold cannot make its own food. It needs green plants to help it get its food.

The warms the earth. The sun also warms all the living things on the earth. The sun helps all of the living things to stay alive.

We measure how warm something is by using a If something gets hot enough, it may burn. Then you may see a . Fires can be helpful or harmful. You must be careful when you are near a fire.

Your feelings can help you to find out about many things. Sometimes you feel . Or you may feel . You may feel . Or you may feel . You may also feel or .

You have learned many things about yourself and about the world. Do you remember?

Vocabulary and Sentence Structure

The Macmillan Science Series is designed to present meaningful content that is interesting and challenging to pupils. The authors have recognized the reading problem involved in presenting worth-while content, and have met this problem by (1) using a carrying vocabulary of words commonly found in readers, and (2) carefully presenting selected science words to help the pupil gradually acquire a science reading vocabulary.

To keep this text at an easy second grade reading level, the authors have used through page 107 a carrying vocabulary of words commonly found in pre-primers, primers, and first readers. Beginning with page 108, the authors have gradually introduced second-reader words. Throughout the text, words that were given special attention in the first book of this series are included in the carrying vocabulary.

Picture labels, used occasionally, are not necessary to an understanding of the text. The pupil can easily "read" many of these words by naming the items in the accompanying pictures, and the better readers will acquire many of these words permanently. Some of these labels may be new words to the pupil—*zebra fish*, *dandelion*, *Spanish nettle*, for example. The teacher should pronounce such words for the pupil and encourage him to use them, but they are not to be taught for mastery.

The following list consists of words in the text (and headings) that fall outside the carrying vocabulary. The appearance of a word in this list does not mean the word is inherently difficult, but merely that the pupil may not have encountered it often enough to recognize it.

1. Tom
   Jane
   taste
2.
3. onion
   lemon
   bitter
   chocolate
4. note
   different
   gently
5.
6. Bob
   Mary
   Jerry
7. cookies
   dough
8. heavy
9. really
   circle
10. scale
    measuring cup
    ruler
    thermometer
    speedometer
11. magnifying lens
    microscope
    field glasses
12. Judy
    Fred
    maybe
13. cocoon
    alive
14. caterpiller
15. living
16. moth
17.
18. butterfly

18. feelers
19.
20. aquarium snails
21. goldfish
guppies
zebra fish
22.
23. quart bottles
24.
25.
26. scientists
27.
28.
29.
30.
31.
32.
33. forces
34.
muscles
35.
36.
37. direction
38. rubber band
39. steady
Anne
Dick
speed
40.
41. size
Paul
42. Lucy
43. Jim
David
44.
45.
46. suddenly
47. Linda
48. Susan
49. easier
50. pulley
raise
pole
51. airports
52. gear
53. windup
apart
spring
unwinds
54. cord
55.
56. experiments
special
57.
58.
59.
60.
61.
62. bones
skeleton
shape
63. skull
ribs
backbone
64. shoulder
hip
65.
66. easily
cartons
67.
68.
69. person's
70. joint
elbow
71.
72.
73.
Peggy
seat belts
74. difference
75. muscles
attached
76. Peter
touch
bend
straight
77. thicker
narrow
78. pairs
79.
80.
81.
82.
83.
84.
85. trunk
86. stems
roots
87.
88. bean
cucumber
peach
89. maple
dandelion
90.
91. towels
soil
aquarium
92.
93.
94. package
95. chart
96. travel
97. Spanish nettle
burr
98. bulbs
whole
99. hyacinth
narcissus
tulips
100. cuttings
101.
102.
103. fairy ring
cup fungi
boletus
puff balls
104. moldy
study
105.
106.
107.
108.
109. heat
110. important
111.
112.
113. liquid
degrees
pour
temperature
114. sunlight
115.
116.
117.
118.
119.
120. pipe
121.
122.
123.
124. unless
grownup
125. being
dangerous
126. safe
127. matches
128. blanket
129.
daffodils
130. fever
131. warm-blooded
132. cold-blooded
133.
134.
135.
136. sweating
137.
138.
139.
140.
141.
142.
143.
144.
145.
146.
147.
148. lightning
storms
149.
150. snakes
Mr. Rodman
151. coral snake
rattlesnake
copperhead
water moccasin
152. dared
153. angry
scolded
Nancy
happen
understand
154.
155. hurt
156.
157.
158. lose
159.
160.

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